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# ANCIENT MAN, HIS ENVIRONMENT AND HIS ART

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THE relation of culture to the environment is always a fruitful theme for discussion. To minimize the difficulties in the way of reconstructing the environment of the earliest races of man would be to deny the all-pervasive influence of environment as a factor in human development. We are so accustomed to think in terms of our own surroundings that any other set strikes us at once as strange and unreal. This is particularly true when we attempt at one fell swoop to divest

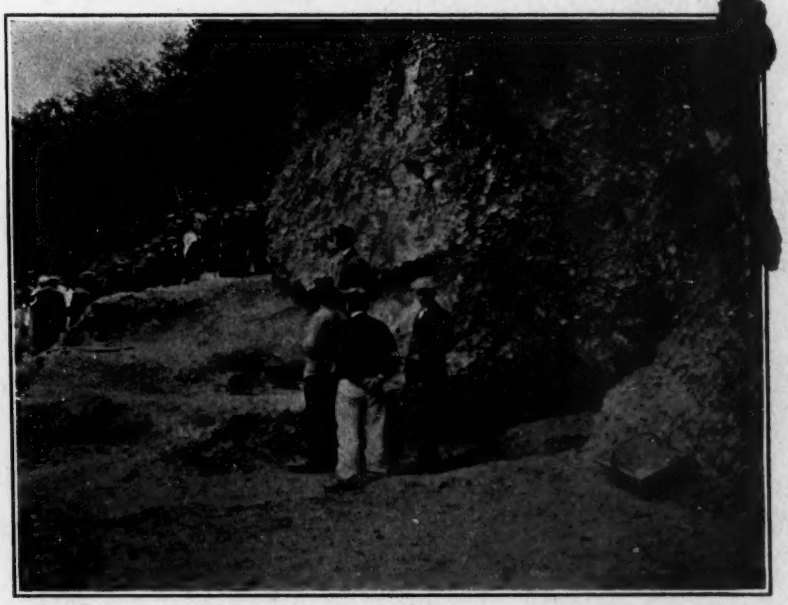

FIG. 1. A GREAT MOUSTERIAN ROCK SHELTER, where a female skeleton of the Neanderthal type was recently found. Photographed by G. G. MacCurdy.

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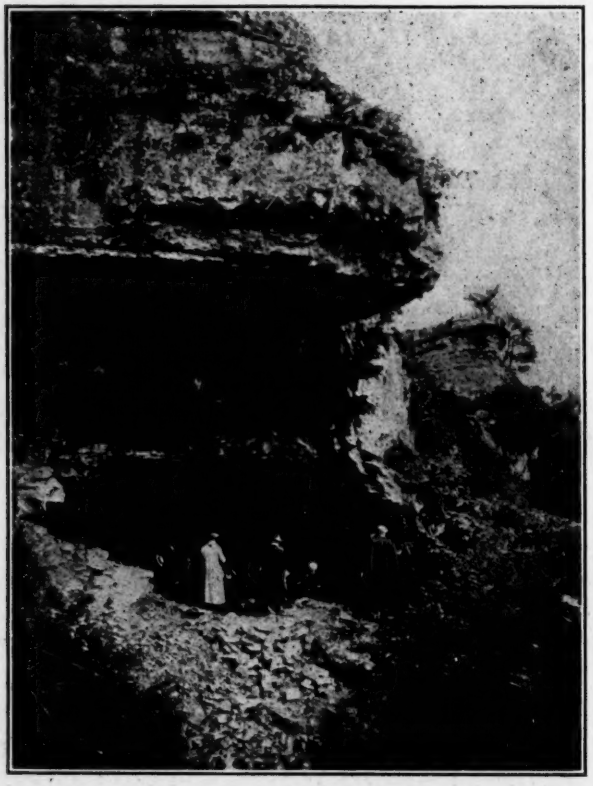

FIG. 2. GREAT CAVE OF PLACARD (CHARENTE), where drinking cups made of the top of the human cranium were found. Photographed by G. G. MacCurdy.

ourselves of the heritage of all the ages and assume the primitive rôle of *Eoanthropus* for example.

Environment presupposes mind, matter, space and time. With these combined in workable proportions it is conceivable how the resultant might be that thing we call human culture. Mind, with its power to register and to profit by its own experiences, is that which has leavened the lump. As long, however, as those accumulated experiences remained individual, there was no real progress. Means had to be devised to translate individual experience into racial experience. The one who discovered this secret, who first deposited that little bank account on which the race has ever since drawn, is entitled to be called the first man.

There were from the beginning as there are to-day individuals with exceptional minds, who contrived to live up to the full measure of the light that was given them, thus contributing little by little to racial experience, which at first could help them very little in return; but which as it grew and as ways were found to make it more generally available became a dominant factor in the racial uplift.

From the start then we must think of man as an inventor. What was his first invention? Aside from air and water, food-getting and defense are the primeval needs. These are met precariously without artificial aids. Something to supplement the teeth, the nails, the fist must be found; and to be found must be at hand and appeal readily to the senses. The most omnipresent and tangible of all raw materials are stone and wood. Both of these are especially abundant along water courses. In fact, man and wood and game, the latter primitive man's chief food supply, are all there for the same purpose—in search of water. The stones are there because the streams carried them or laid them bare. The problem is therefore one of utilization. The most utilizable of all stones is flint because of its hardness and mode of fracture, leaving a sharp, comparatively straight edge. Moreover, flint flakes can be produced by purely natural means. The accidental stepping on one of these would suffice, after repetition at least, to prove their efficiency. Thus the oldest and most primitive implements that have come down to us are utilized flint chips. Once the flint-using habit was formed, it spread; and when the natural supply became scarce it was supplemented by artificially produced chips.

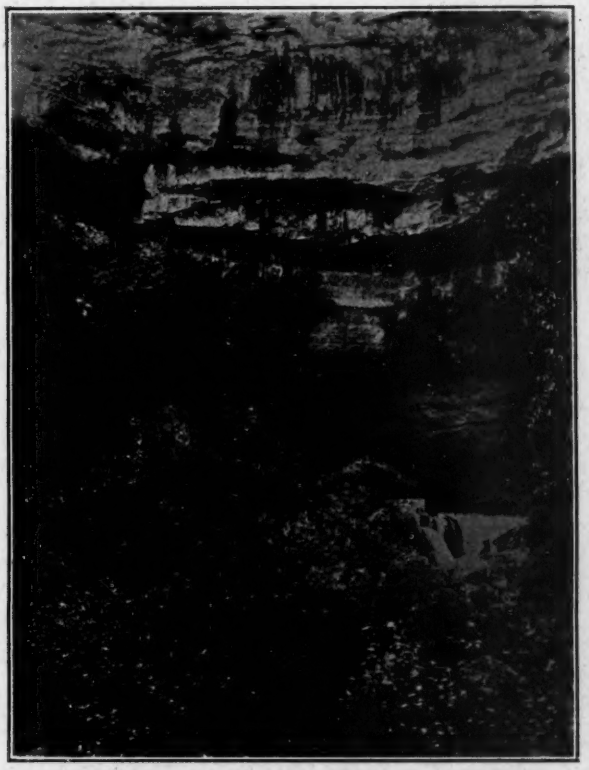

FIG. 3. MAS D'AZIL (ARIÈGE), which gave its names to Azilian epoch: transition from paleolithic to neolithic. Photographed by G. G. MacCurdy.

The chief sources of flint are the chalk deposits of Cretaceous age that occur so plentifully in western Europe, as seen, for example, in the white cliffs along the southern coast of England. Approaching one of these cliffs, you will find it studded with parallel beds of flint nodules. Wherever flint occurs stone-age relics are apt to be abundant. The chalk of England, Belgium and northern France is the same age as the flint-bearing calcareous deposits of Spain and southern France; but the latter have not the white chalky appearance and are much harder;

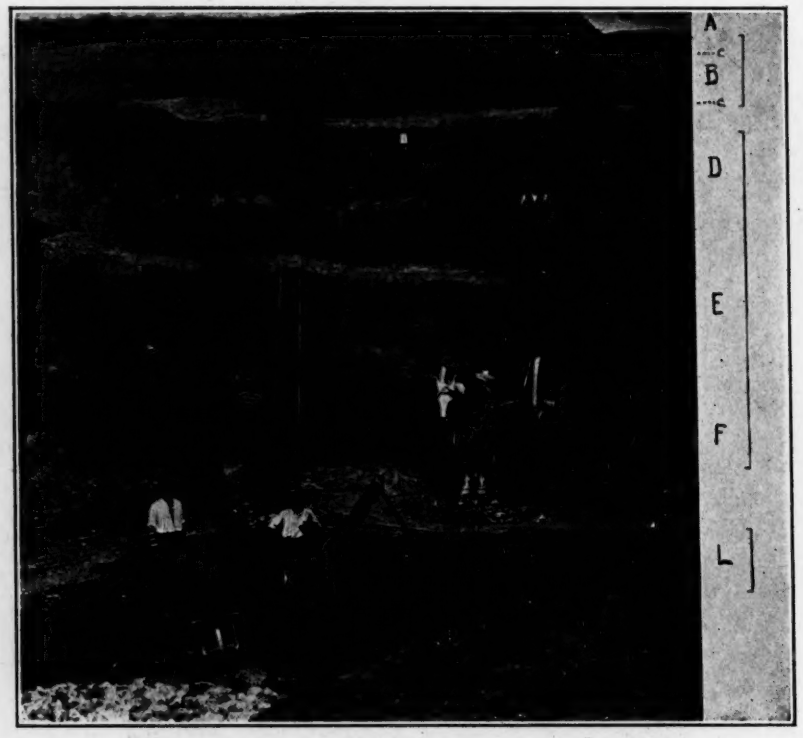


FIG. 4. TELLIER QUARRY, ST. ACHEUL. Third terrace.

hence are full of caverns and rock shelters about which we shall speak later.

One great difficulty that confronts the student of human origins is the paucity and fragmentary character of the evidence. This evidence is limited to two kinds: skeletal and cultural remains. The first of these is the rarest and at the same time the most incontrovertible. Not one complete skeleton has as yet been found. The less durable parts are missing. The cranial cap, the lower jaw, a few teeth, bones of the extremities, are the somatologist's chief sources of information. Except in rare instances, the face bones and the base of the skull are missing.

Of *Pithecanthropus* we have only the cranial cap, a few teeth, and a femur; of Heidelberg man, only the lower jaw; of the Piltdown skull, the greater part of the brain case, including a portion of the brow ridge, and the right half of the lower jaw. Osseous remains of Neandertal man and the later paleolithic races are more abundant. Of *Homo neandertalensis* alone there are now at least twenty authentic examples.

The mentality of early man is reflected in the size and structure of

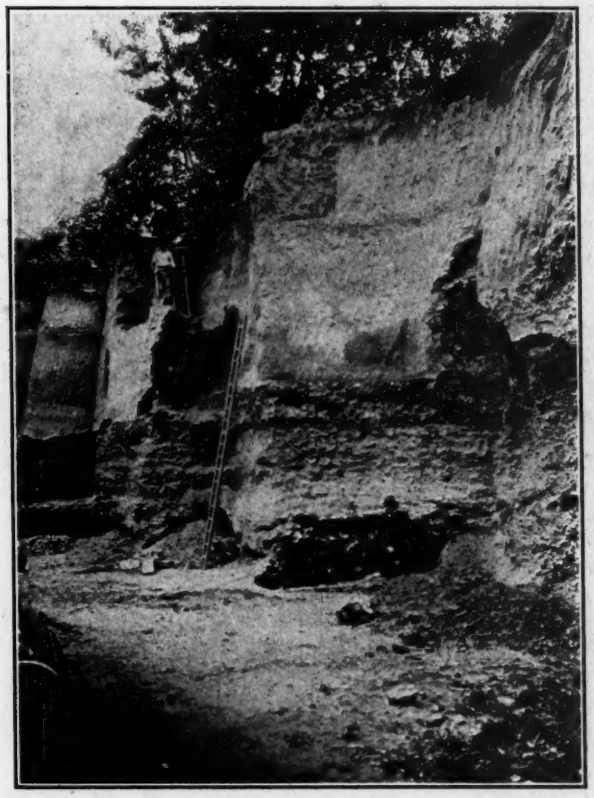

FIG. 5. FOURTH OR YOUNGEST TERRACE AT AMIENS. Photographed by G. G. MacCurdy.

the brain. Casts of the cranial cavity have been studied with great care. The cranial capacity of *Pithecanthropus* is estimated at 850 c.c., placing it in this respect nearer to the minimum in man than to the maximum in anthropoids. The cranial capacity of the Piltdown skull (*Eoanthropus dawsoni*) is given by Dr. A. Smith Woodward as not less than 1,070 c.c. The Piltdown skull apparently belonged to a female, and according to Professor Elliott Smith its brain case, though smaller and more primitive in form, is not unlike those of Gibraltar and La Quina, both paleolithic and supposedly feminine. The most striking feature

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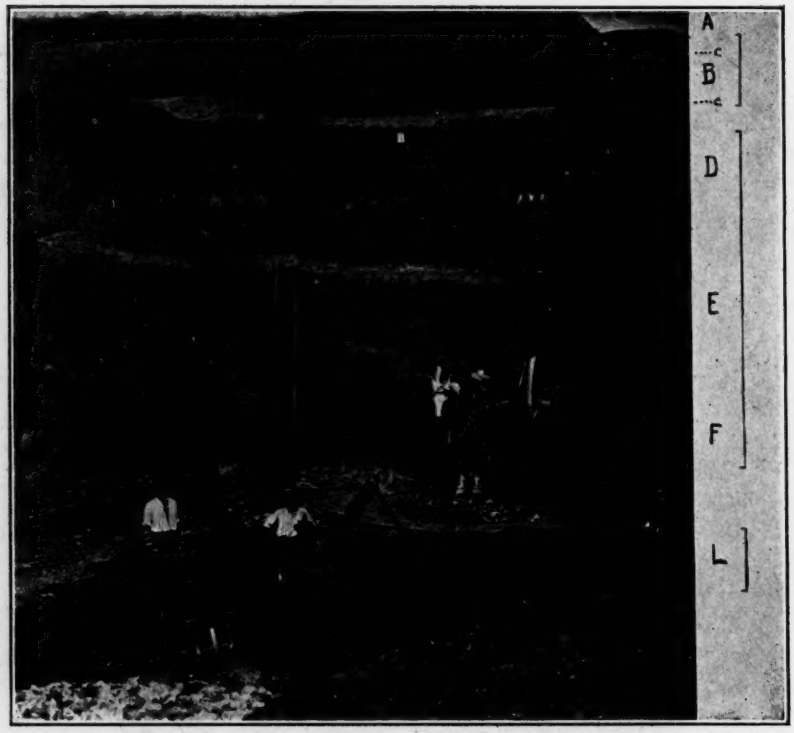


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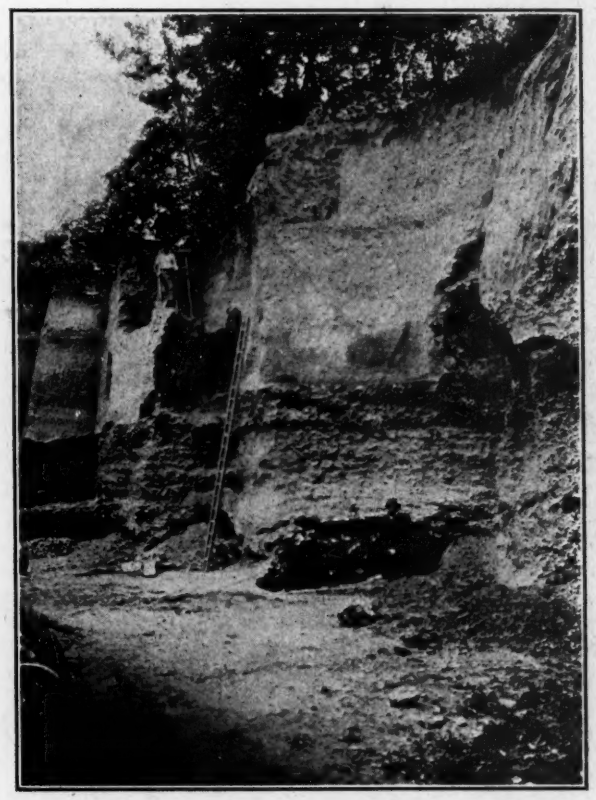

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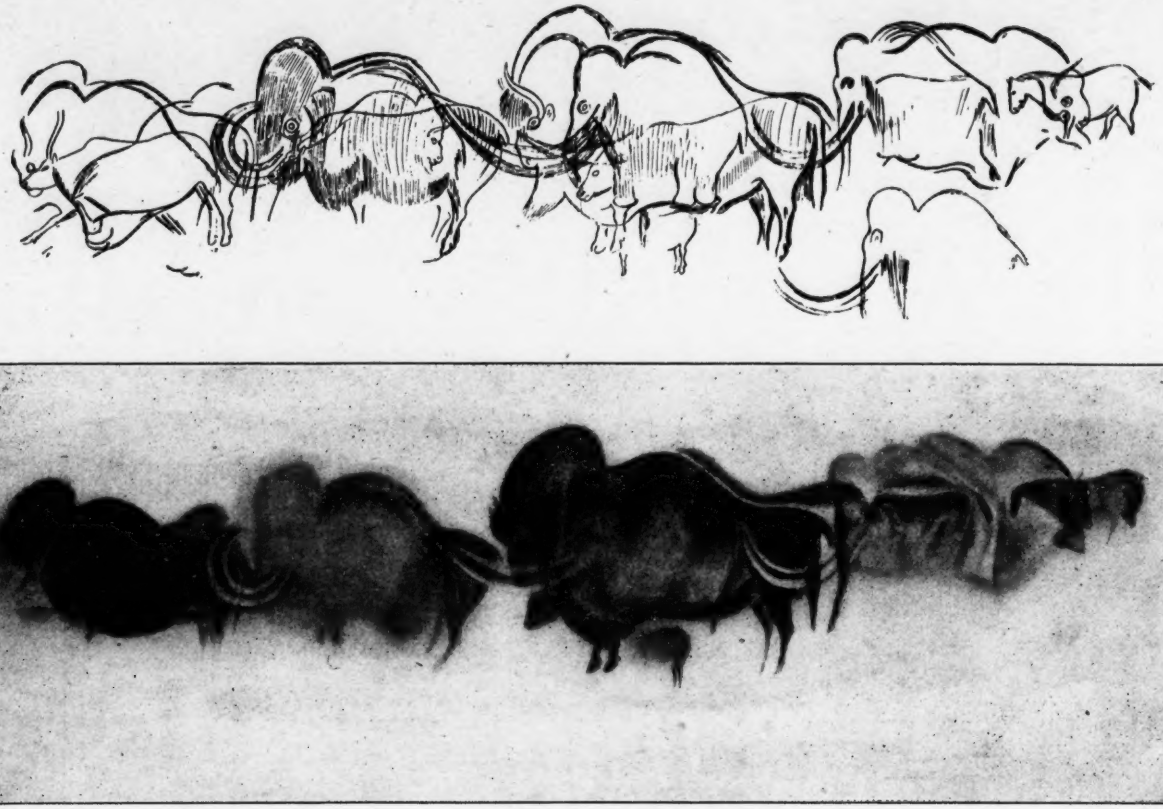


PL. I. GREAT BAND OF FRESCOES SIX METERS LONG; the basis of engraving is seen in the upper half of the picture. Cavern of Font-de-Gaume (Dordogne). After Capitan, Breuil and Peyrony. La cavern de Font-de-Gaume aux Eyzies (Dordogne).

is the "pronounced gorilla-like drooping of the temporal region, due to the extreme narrowing of its posterior part, which causes a deep excavation of its under surface." This feeble development of that portion of the brain which is known to control the power of articulate speech is most significant. To Professor Smith the association of a simian jaw with a cranium more distinctly human is not surprising. The evolution of the human brain from the simian type involves a tripling of the superficial area of the cerebral cortex; and "this expansion was not like the mere growth of a muscle with exercise, but the gradual building-up of the most complex mechanism in existence. The growth of the brain preceded the refinement of the features and the somatic characters in general." The Piltdown skull with its primitive brain and simian lower jaw, but with a frontal profile suggesting the modern rather than the Neandertal type, tends to prove that in the lower Quaternary the differentiation among Hominidæ had already progressed much farther than has been generally supposed; and that we shall have to go a long way back in the past to find the parting of the ways between the ancestor of man and that of his nearest of kin among the apes. The capacity of some of the male skulls of the Neandertal type is unusually large, but the brain still lacks the superior organization that characterizes the modern human brain. The Neandertal race seems to have disappeared rather suddenly at the close of the Mousterian epoch. Art-loving Aurignacian man was of a different type both physically and mentally.

Cultural remains, although much more abundant, are confined wholly to durable materials such as stone, bone, horn, and ivory. Pottery and metals are durable, but the fact that they do not occur is very good negative evidence that they were unknown. We are justified in assuming that wood, bark, roots, plant stems, skins, etc., were used, but not one trace of these has been preserved. It is also fairly safe to assume that fire-making was a very early invention of man, for unmistakable traces of it are found as far back as Mousterian times (and have been reported by one author in the Acheulian and Chellean).

The hearth suggests a roof and these the family and possibly the tribe. At Torralba, Province of Soria, Spain, the Marquis of Cerralbo has recently uncovered a large camp site, which has yielded an association of rude eolithic and Chellean industry with the remains of a very old fauna: *Elephas antiquus* (and possibly also the Pliocene elephant), *Rhinoceros etruscus, Equus stenonis,* and a large and small deer. Some sort of tribal organization would naturally develop under such conditions.

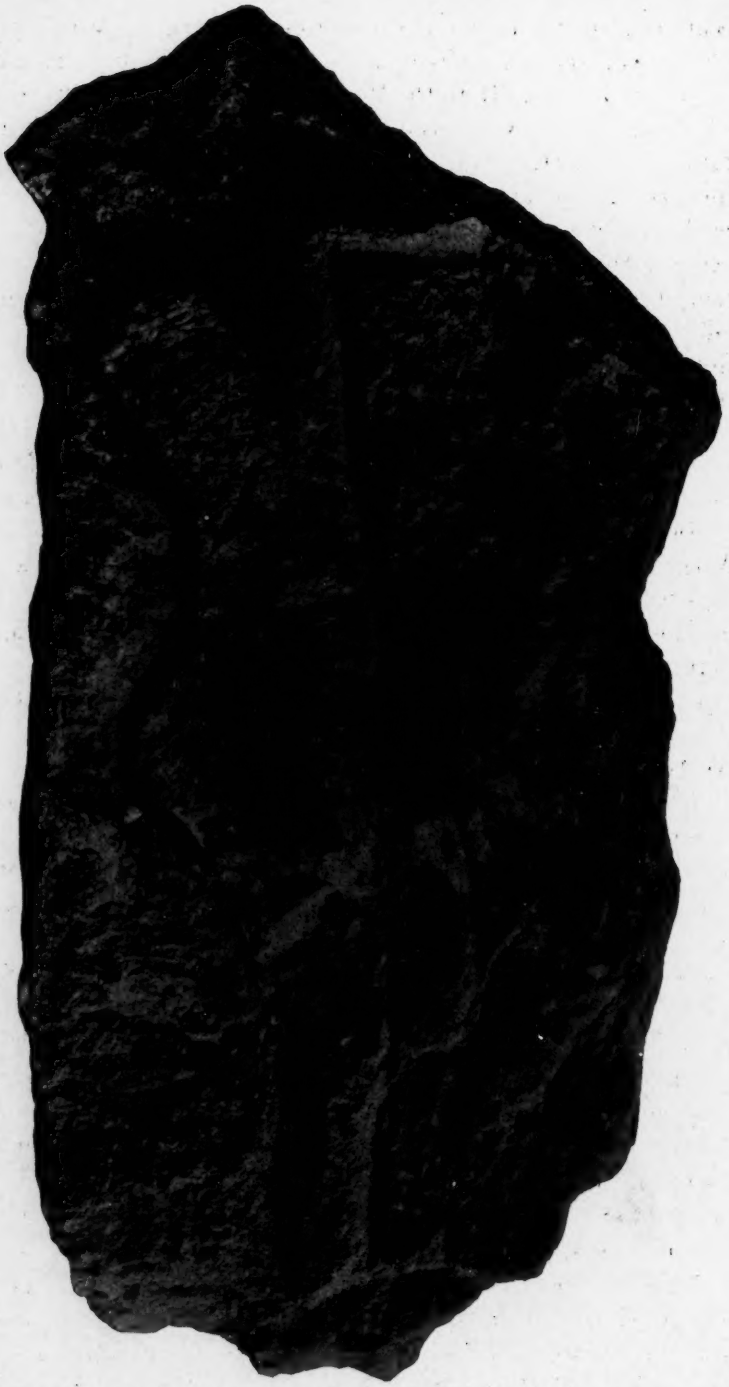
Man very early sought shelter under overhanging rocks and in caverns, but these are limited geographically while man's range was practically unlimited. La Quina (Charente) was in Mousterian times a mag-

PL. II. BAS RELIEF FROM THE ROCK SHELTER OF LAUSSEL (DORDOGNE), representing a nude female holding a bison horn; Aurignacian age. After Lalanne. "L'Anthropologie," XXIII., 131, 1912.

nificent rock shelter facing the northwest, but the overhanging rock weathered away long ago, leaving a thick talus slope over the relic-bearing deposits (Fig. 1). Here Dr. Henri Martin found a nearly complete female skull of the Neandertal type and a portion of the skeleton. Placard (Charente), occupied in Mousterian, Solutréan, and Magdalenian times, is a great shallow dry cave, a comfortable and picturesque home for early man (Fig. 2). Equally picturesque is Mas d'Azil (Ariège), a subterranean stream bed with connecting caverns occupied by man in so-called Azilian times, that is to say at the very close of the paleolithic period (Fig. 3). Shelters were evidently produced artificially at an early date, and no doubt varied according to locality just as they do among primitive peoples of to-day. The ancestral hairy coat was not discarded all at once, and before it ceased to be functional, some exceptional mind had set a new fashion in garb. In more favored climes this might well have been nothing more than the proverbial fig leaf. In colder regions recourse would be had to skins of animals.

Much has been written concerning man and the glacial period, or perhaps more correctly the glacial epochs; for there seem to have been about four of these, all (or at least three) of which belong to the Quaternary. The phenomena of fourfold terraces in the valleys of Europe are widespread. To what extent these may be correlated with the four glacial epochs is still an open question.

At Amiens in the valley of the Somme, flint implements have been found in all four terraces. Of the oldest two terraces at a height of 75 and 55 meters, respectively, above the sea, very little remains. A typical pre-Chellean or eolithic industry has been found in the old gravel of the second terrace. The third terrace about 42 meters above the sea is made up of gravel at the bottom and two loess deposits, an old loess and a recent loess (Fig. 4). Chellean industry occurs in the gravel, Acheulian industry in the old loess, and Mousterian and Solutréan industry in the recent loess. That a considerable period elapsed between the deposition of these two loess deposits is proved by the presence of the so-called *limon rouge* at the top of the old loess, representing an old land surface, just as the brick earth at the top of the recent loess represents a decalcified land surface—the present one. The fourth terrace, the one last to be formed, is only 20 to 28 meters above the sea, the 8 meters representing the thickness of the terrace (Fig. 5). Beginning at the bottom, it is composed of coarse gravel with Chellean industry; a whitish layer of sand and gravel containing an ancient Mousterian industry associated with a warm fauna (*Elephas antiquus, Rhinoceros merckii, Hippopotamus*); a sterile layer of fine gravels; and lastly a thick deposit of recent loess with two horizons of later Mousterian industry.



PL. III. MALE FIGURE IN BAS RELIEF, Aurignacian age; rock shelter of Laussel. (Dordogne). After Lalanne, "L'Anthropologie," XXIII., 147, 1912.

Across the Channel in the Ouse valley, at Piltdown, Fletching (Sussex), there has recently come to light a flint-bearing gravel with a remarkable association of human osseous and cultural remains with those of a Pliocene and Quaternary fauna (Pliocene elephant, *Mastodon, Hippopotamus, Cervus elaphus,* beaver, horse). The gravel bed is 80 feet above and a mile removed from the present bed of the Ouse. The physiographic features of this region have suffered no appreciable change since Roman times, hence the relation of the present Ouse bed to the one that existed when the Piltdown gravels were deposited indicates a great antiquity for the latter. All the relics in it are certainly

FIG. 6. *Eoanthropus dawsoni.* (½ nat. size.) After Dawson and Woodward. *Q. J. G. S.*, LXIX., 141, 1913.

as old as the deposit. All or some may be older. The somatic characters of the human skull (Fig. 6), especially the lower jaw, postulate great antiquity, as does the nature of the rude flint implements. That the latter were found in association with a very primitive human type would seem to give such implements a standing hitherto denied them by some authorities; unless it can be proved that they were derived from a deposit antedating the one which originally contained the human remains. Their pedigree was needed in order to make industrial genealogy complete, just as the skull itself was needed to fill a gap in man's physical evolution. It remains for the geologists to determine whether in Piltdown the prehistorian's "Rosetta stone" has at last been found. Perhaps they will be able to tell us also whether a channel separated the man of Piltdown from his contemporaries in the near-by valley of the Somme. The present channel dates from the very close of the paleolithic period. That there was a channel in early paleolithic times is

PL. IV. A BISON ON A COLUMN OF STALAGMITE; the artist completed a figure already blocked out fortuitously by nature. Cavern of Castillo, Puente Viesgo, Spain. After Alcalde del Rio, Breuil and Sierra. Les cavernes de la région Cantibrique (Espagne).

suggested by raised beaches near Calais and on the south coast of England.

All things considered, it looks as if pre-neolithic man had to contend with more than one glacial epoch, which means an environmental disturbance of the first magnitude. Think, for example, of a great continental ice-sheet creeping slowly but inevitably down upon New York City. What an overturning of unearned increments! What a succession of *Titanic* disasters at sea! But unearned increments and floating palaces were happily non-existent in past glacial times. Pre-neolithic man simply abandoned his wind-break or folded his tent of skins and carried it with him. Besides the European continental ice-sheet never reached quite so far south even as London; it never covered the spots where the Piltdown skull and the Heidelberg jaw were found. There was, to be sure, a considerable extension of the Alpine and Pyrenean glaciers, but there was always enough room for safety and the survival of those best adapted to the environment.

The wide distribution in Europe of flint-bearing chalk deposits makes it almost an ideal place for the evolution of a stone-age culture. In many parts of Europe these flint-bearing deposits also afforded man ready-made shelter in the shape of caves and overhanging rocks. They are usually in proximity to water courses, and frequently so bunched as to invite a relatively dense population; these became centers of culture.

Such favored regions as the foothills of the Cantabrian Mountains in Spain, those of the French Pyrenees, the Italian Riviera, and Dordogne go a long way toward explaining the origin and evolution of paleolithic art. The great cave group of the Vézère valley became the Paris of the antique world. Here the arts flourished to a remarkable degree, beginning with the Aurignacian epoch and continuing through to the close of the paleolithic.

It must be remembered that these early artists were limited in their choice of materials. Pebbles, pieces of schist or slate, fallen fragments from the overhanging calcareous rock, bone, reindeer horn, ivory were all utilized; but the most notable works were executed on the walls of caverns and rock shelters. Suitable wall space was at a premium; the result is that one often finds superposed figures two, three and even four deep covering the same wall space. One of the best examples of this is the great band of frescoes, five meters long, which shows interlocking of figures as well as superposition (Pl. I.). Here as in practically all polychrome frescoes there is a basis of engraving which also prepares the field for the color. This foundation of engraving is seen in the upper half of the plate. The band is readily divided into four groups or sections. To the first group belong three figures all headed

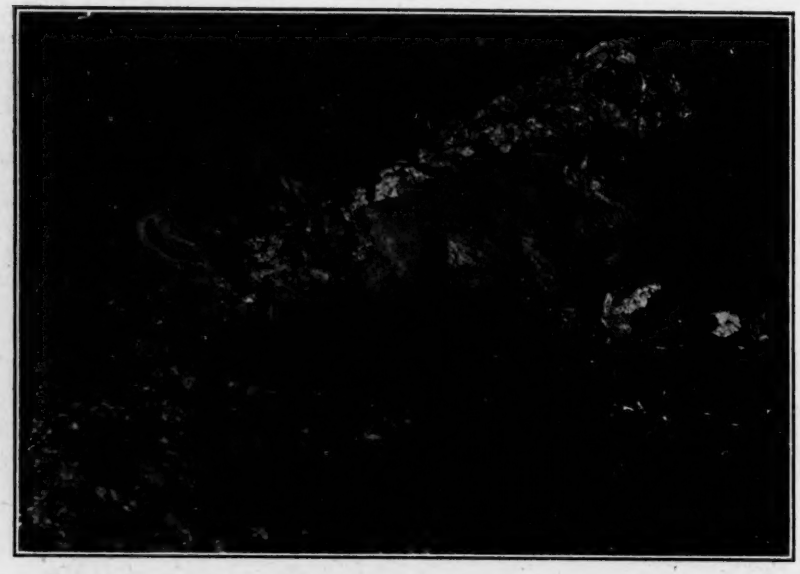


FIG. 7. MALE AND FEMALE BISON MODELED IN CLAY, discovered October, 1912; from cavern of Tuc d'Audoubert (Ariège). Votive offering for multiplication of the bison.

in the same direction. The lines of the reindeer cut all others, hence it is the latest of this group. The bison comes next, its head being hidden in part by that of the reindeer. Underneath the bison are the imperfect outlines of a mammoth recognized by the contour of the head and back, and the feet. In section two the mammoth is on top. Beneath come

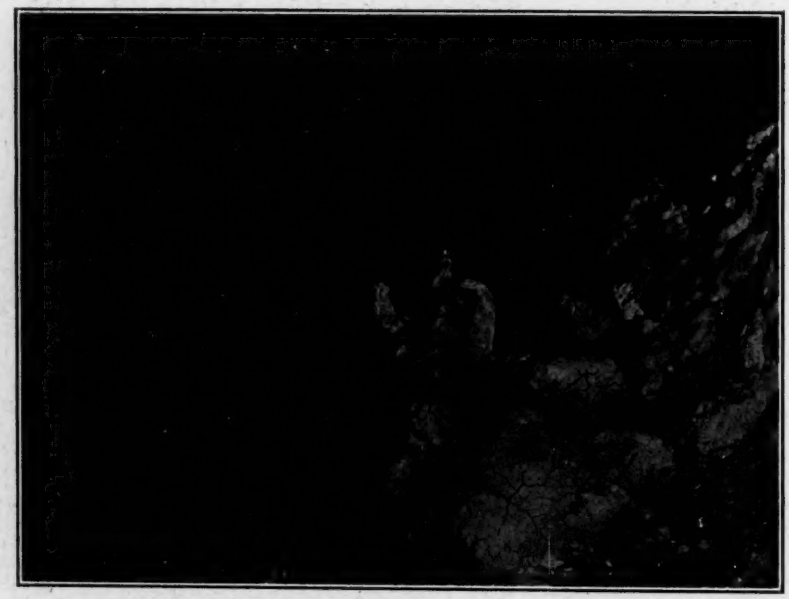


FIG. 8. FEMALE BISON, front view; cavern of Tuc d'Audoubert (Ariège).

first a reindeer and lastly a bison with the head toward the right. The mammoth is again the latest of the figures in group three. It was incised over the figure of a great bison. Older than the bison is the reindeer; and oldest of all, the small figure of a horse, with the exception of the rump almost obliterated by subsequent drawings. The order for the fourth group beginning with the latest figure is: mammoth, bison, and horse. Below this ensemble is a finely engraved mammoth. That such superposition was in a large measure unconscious, unintentional,

FIG. 9. ENGRAVED FIGURE OF THE HORSE WITH ARROWS STICKING IN HIS SIDE. Cavern wall of Tuc d'Audoubert (Ariège). Votive offering for success in the chase.

there can be little question. This superposition sometimes marks a lapse of considerable time and may be of service in the dating of mural art in general.

Quite recently engraved slabs of stone have been found at La Madeleine, some of them from refuse worked over years ago by Lartet and Christy. These and similar specimens from Limeuil (Dordogne) are now the property of the Museum of National Antiquities at St. Germain. Monsieur L. Didon has found engraved slabs of Aurignacian age in the rock shelters at Sergeac (Dordogne), one of which representing a horse and found in 1912, now belongs to the American Museum of Natural History. Still more remarkable are the bas reliefs of upper Aurignacian age from the rock shelter of Laussel (Dordogne) representing the human form. Four of these depict a female type already familiar through discoveries at Brassempouy (Landes), Mentone and

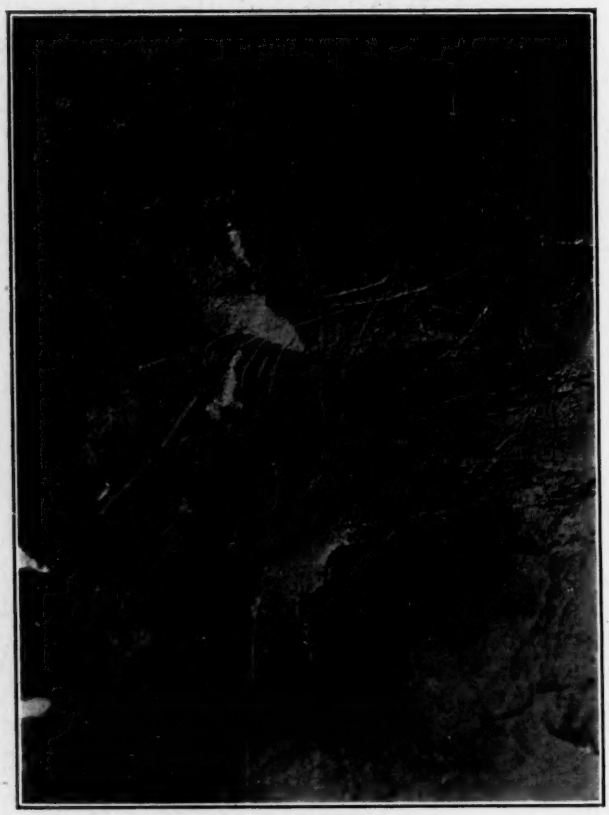


FIG. 10. HEAD OF REINDEER ENGRAVED ON CAVERN WALL AT TUC D'AUDOUBERT (ARIÈGE). A club-shaped figure across the head. Votive offering for success in the chase.

Willendorf (Austria). In all there is an evident exaggeration of certain female characters rather than a serious attempt to copy nature faithfully (Pl. II.). The lines of the male figure, who has apparently just let fly an arrow from his bow, are fairly true to the original (Pl. III.). The bas relief of the female holding the bison horn was painted red; traces of the color still persist not only on the body but also over all the cut portion of the rock. The practise of painting engraved and relief figures was no doubt quite general, examples having been reported lately from La Madeleine and Castillo (Spain).

The paleolithic artist was quick to detect in the configuration of the rock a resemblance to animal forms and to heighten the resemblance by judicious use of engraving or color. To illustrate this point the figure of a bison on a column of stalagmite in the cavern of Castillo near Puente Viesgo, Spain, is chosen (Pl. IV.). It took very little though well-directed effort on the part of the artist to complete a form already blocked out by nature. A few incised lines and the application of color (black) about the head and shoulders sufficed. A bison at Niaux

(Ariège) and a horse at Font-de-Gaume (Dordogne) are also of this class, as is a bovine head in the newly discovered cavern of Tuc d'Audoubert (Ariège). Shortly after his discovery of the cavern Count Bégouen noted two red spots on the wall. The following day it was my good fortune to identify them as a pair of eyes, the animal's head being formed in bold relief by the projecting rock. Such fortuitous objects as these might have been that which originally sensitized the human imagination till it was able to catch and perpetuate a likeness to familiar or cherished forms. With the gradual perfection of the likeness both with and without fortuitous assistance the fine arts were born.

Nothing quite the equal of paleolithic cave art has since appeared among any people in the hunting and fishing stage of culture; for it must be remembered that domestication of animals and the arts of agriculture were neolithic innovations; so was the ceramic art.

It seems almost a pity that this artistically inclined old race was not familiar with the plastic possibilities of clay. What exquisite figures of their favorite game animals they might have left to us, both in the round and in painted forms. Perhaps they did model in clay. If so the objects were not properly tempered and either poorly fired or not fired at all and have since completely crumbled away. Only one

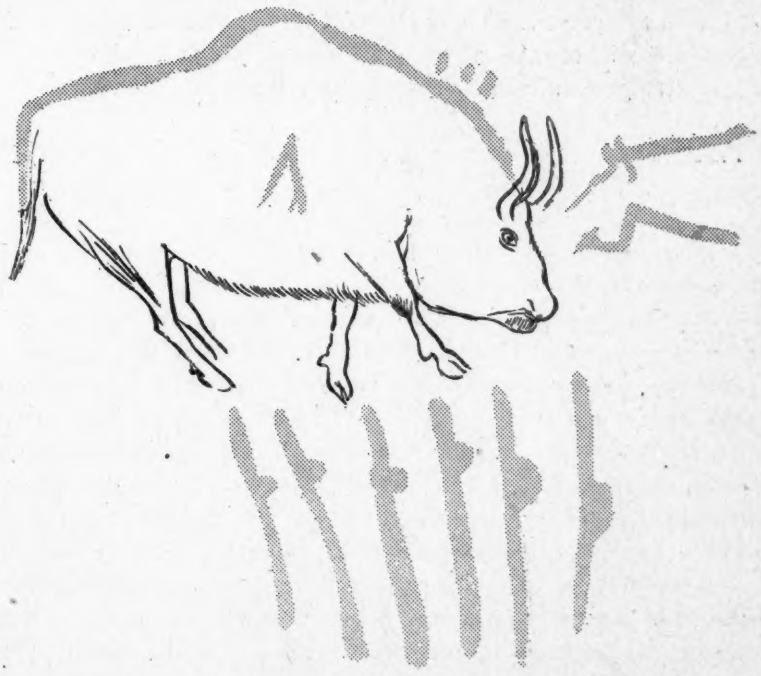


FIG. 11. WOUNDED BISON, in part engraved and in part painted (red); to the right, the head of a horse incomplete; below, six claviform figures. Pindal (Asturias). After Alcalde del Rio, Breuil and Sierra. Les cavernes de la région Cantabrique (Espagne).

instance of paleolithic modeling in clay has thus far come to light, the discovery being made only last October in the newly found (July 20) cavern of Tuc d'Audoubert. I visited this cavern only five days after its discovery by Count Bégouen and his sons, who in continuing their researches less than three months later came upon two clay figures of the bison, a female 61 centimeters long followed by a male 63 centimeters in length. These figures were never wholly separated from the matrix out of which they were so deftly fashioned. They seem to stand out of the sloping clay talus that flanks a fallen rock (Figs. 7 and 8). They are far removed from any known entrance to the cave and were discovered only after Count Bégouen had broken away huge stalagmite pillars that blocked the narrow corridor leading to that particular gallery, which was evidently a paleolithic shrine since mercifully guarded from unhallowed hands by Nature's own silent white sentinels. On the walls of another gallery of this same cavern are engravings of favorite game animals: a horse, with arrows sticking in his side (Fig. 9); a reindeer with a club-shaped figure across its head (Fig. 10).

In visiting a long series of paleolithic caverns with mural decorations one is struck not only by the number of figures of animals wounded by arrows or associated with claviform representations (Fig. 11), but also by the evident desire of the artist to leave his work in a secluded spot difficult of access. Among the most remarkable art works found in the floor deposits of caves and rock shelters are the spear throwers ornamented with gracefully carved figures in the round or in high relief of the animal to be hunted.

These facts would seem to point to one of the cogent reasons for the phenomenon of cave art. To be sure, many of the figures are so meritorious as to make their execution well worth while for the simple satisfaction they must have given to the artist or the chance beholder. Reading between the lines, one may detect other reasons. The art might well have served another purpose. It was called forth no doubt in a large measure to meet an economic need. As the population increased—and no one familiar with the Vézère valley, for example, can fail to be impressed by the evidences of a relatively dense population—as this increased, the food supply of game and fish decreased in inverse ratio. In order to adjust the supply to the ever-increasing demand, recourse was had to magic, to the aid of the spirit world. The female bison closely followed by the male (Fig. 7), the wounded horse and bison (Figs. 9 and 11), the clubbed reindeer (Fig. 10) are votive offerings for the multiplication of game and for success in the chase. In the end magic was bound to fail as it always will. Then passed away the picturesque paleolithic culture, superseded by the neolithic, capable of meeting the demands of an increased population, based as it was on the domestication of animals and plants as well as on the utilitarian potter's art.

# SUSPENDED CHANGES IN NATURE

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IN the physical world we are familiar with the fact that changes of all kinds are continually taking place. Prominent among these are changes of state, such as the evaporation of water, the melting of ice and the condensation of steam. These familiar transformations seem to have a common property; as usually observed they take place at very definite temperatures. To be sure, in the laboratory it is possible to heat water to 105–106° without boiling it, and to cool vapors below the temperature at which they ought to condense, but such experiments have usually been regarded as quite exceptional. Within the last few years, however, it has been found that such a reluctance to enter a new state is by no means unusual, that many cases similar to the above actually exist; moreover, that they are not restricted to ultra-refined laboratory experiments, but are a matter of common experience.

If ice is heated it melts, and the temperature at which this process takes place is sharp and definite, as is evidenced by the fact that mixtures of ice and water are used to calibrate and test the accuracy of the most delicate thermometers. No one has ever succeeded in heating ice above the temperature of its melting point, zero degrees, which is a property that ice shares with other solids such as lead, gold, saltpeter and ordinary table salt. But the reverse is not true, for many liquids can be cooled below their freezing points without solidifying. Water, for example, can be cooled below zero without changing to ice. When water freezes in nature, as in ponds and lakes, the transition of water to ice takes place at this temperature and is fairly sharp, but if a clean flask is filled with water the surface of which is protected from dust by means of a layer of oil, it is easily possible to cool the water ten degrees below its freezing point. True, it becomes solid on shaking the flask or upon the introduction of a fragment of ice, but it can be kept for hours in the liquid state, offering a passive resistance to the forces of nature which are operating to change it to ice, the stable form of water at this temperature. Water that has been cooled below its freezing point in this way is said to be in the metastable state; it is also called undercooled water, that is, water that has been cooled under the temperature at which it ought to solidify. The phenomenon of undercooling is not restricted to water, but is shown by aqueous solutions of salts[1] and also to a marked

[1] Solutions may be said to be undercooled when they have been cooled to a temperature at which crystals of the dissolved substance ought to separate from

extent by melted phosphorus, carbolic acid, and many organic substances like thymol and betol that are seldom encountered outside a chemical laboratory.

Although many undercooled liquids are similar to water in that they may be changed to the stable state by agitation, this property is by no means general. An infallible test for undercooling is the addition of a fragment of the stable substance. Thus a bit of ice causes water to

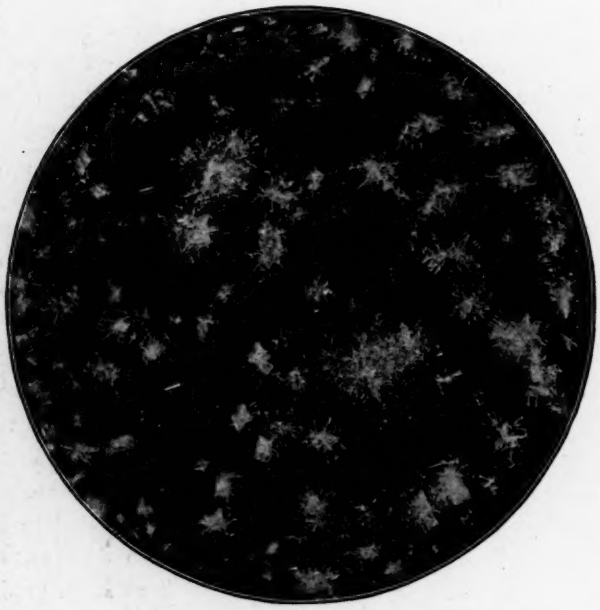

FIG. 1. CRYSTALS GROWING IN UNDERCOOLED THYMOL.

solidify, similarly undercooled thymol becomes a crystalline mass upon the addition of a crystal of thymol, while undercooled sodium acetate solutions at once separate needle-like crystals of sodium acetate when a crystal of that substances is added. The addition of a solid fragment for the purpose of causing subsequent crystallization of the liquid is called inoculation or vaccination. The name is particularly fortunate, for the growth and spread of the crystals resembles a bacterial growth.

Undercooled liquids are as sensitive to the presence of a crystal of the solid material as milk is to the presence of certain bacteria, and just as much care must be exercised in their preservation. In working with undercooled sodium acetate under no circumstances may an open flask of this substance be brought into a room in which sodium acetate has been ground in a mortar, for the dust in the air carries enough finely divided sodium acetate to inoculate the solution. Frequently the in-

the solution, without such a separation taking place. Such solutions are usually said to be supersaturated.

vestigator must take his solution into the open air, but here again he must be careful, for his clothes and hair may carry enough powered material to inoculate the solutions.

The amount of material required to inoculate a solution is very, very small, far beyond the sensitiveness of the most delicate balance. Nowhere in science is the importance of the fact that "the very small is as real as the very great" better illustrated than in the case of undercooled liquids; a human hair lightly brushed against a crystal of thymol will collect enough of this material to inoculate a flask of the undercooled liquid thymol. A tube of undercooled sodium acetate may be divided by a piece of parchment paper into two parts (Fig. 3). The inoculation of the solution in *A* causes the separation of crystals which ultimately appear in *B via* the parchment. The pores in the parchment, which are of microscopic size, become filled with the undercooled solution, and as the crystals forming in the pores can not be larger than the pores it is evident that these crystals are of microscopic dimensions only.

FIG. 2. CRYSTALS GROWING IN A TUBE OF UNDERCOOLED SODIUM ACETATE SOLUTION.

How far can a liquid be cooled below the temperature at which crystals ought to separate? This depends entirely upon the substance used. With some liquids if the undercooling is greater than a degree or two, crystals at once separate spontaneously from the solution. In the case of water the undercooling has been carried to as low as twenty degrees below zero before crystals of ice separated.

Sodium acetate on being strongly undercooled shows an interesting property, for as the temperature becomes lower and lower the liquid becomes less mobile until at fifty degrees below zero just before spontaneous crystallization the liquid assumes a viscous glassy appearance. Its similarity to glass is more than superficial. When molten glass is cooled it gradually becomes more and more viscous until finally it has all the appearances of a solid. But at no definite temperature does it suddenly harden, as would be the case in cooling mercury or molten lead. The glass differs from the undercooled sodium

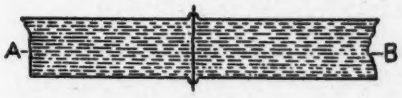


FIG. 3.

acetate in one respect only: its viscosity has reached the solid stage. Glass is an undercooled substance and like other undercooled substances is in the metastable state, consequently it has the power of returning to

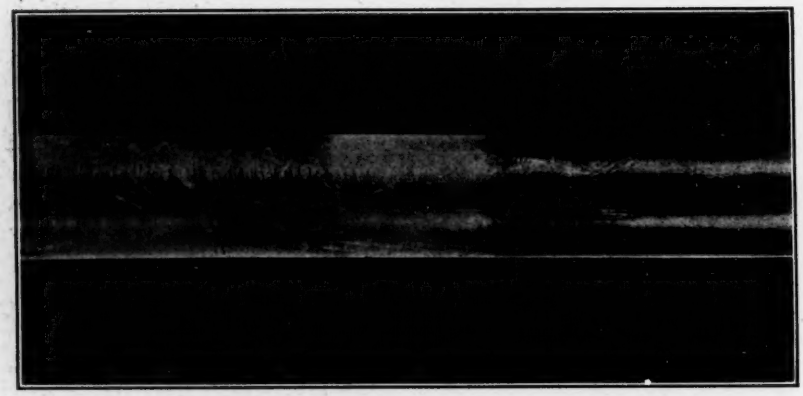

FIG. 4. DEVITRIFIED GLASS.

the stable condition. Old glass, especially glass tubes through which water has been allowed to pass, frequently shows this property when heated for a few minutes. The glass crystallizes, taking on the appear-

FIG. 5. OBSIDIAN FROM WHICH CRYSTALS HAVE BEGUN TO SEPARATE. Magnified about 300 diameters.

ance of ground glass. Its surface becomes rough and the glass is no longer transparent. Pieces of glass apparatus which have partially crystallized can be found in any chemical laboratory. It is called devitrified glass.

Certain glassy appearing minerals like obsidian are really undercooled substances, natural glasses, which have cooled without crystallizing. In the course of time they begin to crystallize. It is not unusual to find in nature numerous samples of these minerals existing in all stages: the metastable, partially crystallized, and the stable or completely crystallized mineral.

FIG. 6. CRYSTALS OF NEEDLE-LIKE OR MONOCLINIC SULPHUR. When first formed they are bright yellow. After standing for a few hours they change to a dull yellow color and become very brittle. A microscopic examination of a fragment shows that it is now made up of minute rhombic crystals (Fig. 7).

The rate of the growth of crystals is a specific property depending on the substance used. Much information has been obtained on this subject by studying the rate at which crystals are deposited from undercooled liquids. By filling a narrow glass tube with the desired liquid, as shown in figure 2, inoculating at one end and measuring the time necessary for the crystal surface to travel the length of the tube, the rate of growth of a crystal can be measured. Undercooled phosphorus crystallizes 200 feet a minute, water at two degrees below zero at the rate of 8 inches a minute, while one thirty-second of an inch a minute is the velocity of crystallization of betol. In nature crystals often grow much more slowly than this.

FIG. 7. CRYSTALS OF RHOMBIC SULPHUR.

The examples cited above deal with undercooled liquids, but the phenomenon of undercooling is by no means restricted to this class of substances.

When molten sulphur is allowed to cool slowly, long lustrous needle-shaped (monoclinic) crystals separate from the liquid. On standing for a few days the appearance of the crystals changes; they lose their luster, and examination with the microscope shows that their crystalline form is no longer needle-like, but consists of so-called rhombic figures. The temperature at which the transition from needles to the rhombic form takes place is 96°.

The change by which water is transferred to ice and its reverse may be represented as follows:

$$\text{At } 0^\circ \text{ ice} \rightleftarrows \text{water.}$$

The arrows pointing in opposite directions indicate that the process is reversible. The significance may be expressed as follows: at 0° ice can be changed to water or water to ice. Similarly in the case of the sulphur,

$$\text{At } 96^\circ \text{ sulphur (monoclinic)} \rightleftarrows \text{sulphur (rhombic).}$$

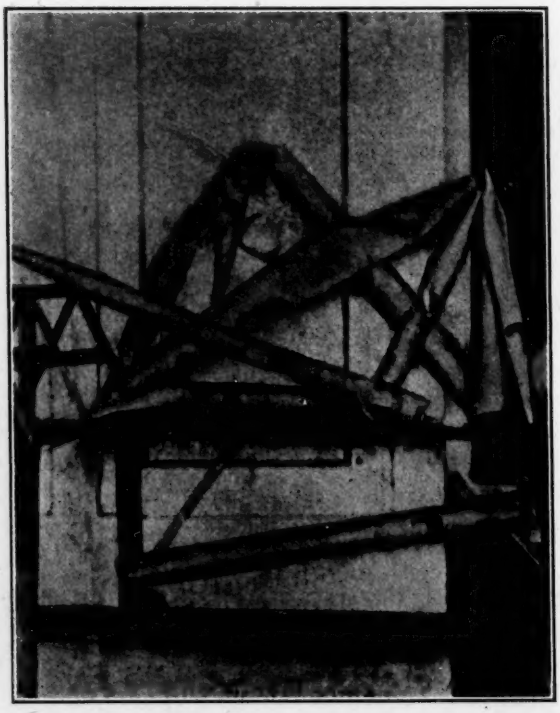

FIG. 8. ORGAN PIPES THAT HAVE BEEN ATTACKED BY THE TIN DISEASE.

Now just as the water at 0° does not always change to ice, but may be undercooled, so the transformation of monoclinic to rhombic sulphur does not take place immediately, but the needles can exist in a metastable state analogous to the undercooled water. And as the addition of a fragment of ice causes undercooled water to solidify, so the addition of a crystal of rhombic sulphur accelerates the change of monoclinic sulphur to its stable form. The rapidity of the transformation of the metastable solid, however, is by no means as rapid as the change of metastable liquids. This is not surprising when we consider how much more inert solids are than liquids, especially when considered from a chemical standpoint.

A most interesting example of the retarded transformation of metals

has been furnished by Professor Cohen of Utrecht. Tin is a white crystalline metal which does not corrode readily and under ordinary conditions appears very permanent. After a particularly cold winter in one of the small towns of northern Germany, it was noticed that in one of the churches the tin pipes of the organ were full of holes and that the tin around the edges of those holes was brittle and would crumble to powder very easily.

A similar occurrence had been reported in St. Petersburg where, after a severe winter, blocks of tin which had been stored in the custom house were found to have crumbled to powder and a number of cases of tin buttons used for military uniforms had undergone a similar change. It was noticed that in the case of the organ pipes, and also on the tin roofs of certain public buildings, the tin had taken on in spots a wartlike appearance; moreover that the warty growth seemed to have the power of spreading. Wherever the tin had changed in this way it had lost its original properties and would easily crumble to gray powder. Because of the appearance of the tin and the spread of the warts over its surface this phenomenon was called the "tin pest" or the "tin disease." That the powder found was still tin and not a product of the corrosion of the metal was easily demonstrated, but the transition of a bright malleable metal to a dull gray powder was for many years a great mystery. But just as there are two kinds of sulphur which can be transformed into each other, so Professor Cohen showed that tin exists in two forms, white tin with a specific gravity of 7.28 and gray tin with a specific gravity of 5.79. These two forms can be transformed into each other, the transition temperature being 18°;

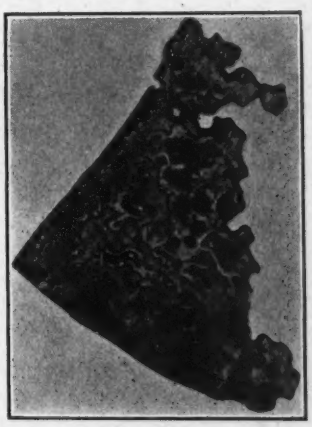

FIG. 9. THE SPREAD OF THE TIN DISEASE ON A PIECE OF SHEET TIN.

$$\text{At } 18^\circ \text{ tin (white)} \rightleftarrows \text{tin (gray)}.$$

But if gray tin is stable below 18° how can we explain the fact that tin pails and tin pans remain bright year after year? The average temperature of the northern part of the United States is far below 18°, consequently why do not our tin utensils crumble into the gray modification of the metal? Fortunately for the housewife, the white tin exhibits to a marked degree the property of metastability. It remains unchanged at temperatures far below 18° and even contact with the gray tin changes it but slowly to the stable form. But once let the transformation of the tin begin, and the spread of the disease is certain. The surface of the tin becomes disfigured with blotches which gradually

spread until the whole substance succumbs to the disease. Results of the tin pest are frequently found in museums. A tin vase in the British Museum which was found in Appleshaw, Hampshire County, England, and which dates back to 350 B.C. shows very strikingly the effects of the tin disease. The metal is not corroded, but it is dull in color and is so brittle that it can be broken with the fingers. Some of the fragments on being melted gave white tin with its original toughness and luster.

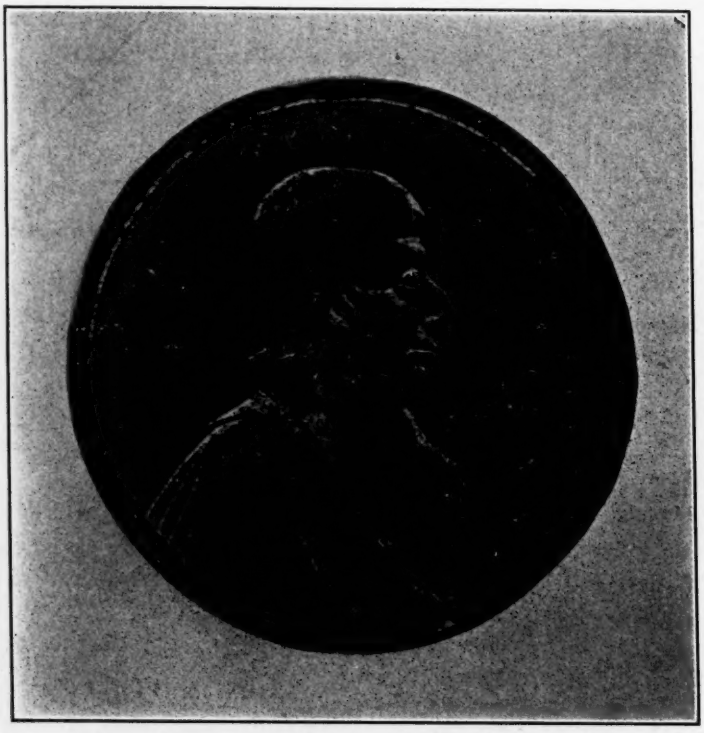

FIG. 10. A TWO-HUNDRED-YEAR-OLD MEDAL THAT IS SUFFERING FROM THE TIN DISEASE.

Every one who has studied the advance of science during the last few centuries realizes that our modern inventions and processes of manufacture have been in many cases foreshadowed in the ancient world. The use of gunpowder by the Chinese and their extraordinary success with glazes, as well as the perfection obtained by certain of the old civilizations in the use of cements, pigments, dyestuffs and in metallurgical processes, is familiar to every one. What the modern scientist discovers by painstaking investigation was learned in those days either by accident or as the result of centuries of experience. Consequently the fact that the tin disease was known in those days ought not to be surprising. Professor Cohen has pointed to an observation of Aristotle.

> They say that Celtic tin melts much more easily than lead. A proof for the fusibility is that it melts even in water. It is apparently very sensitive to exterior influences. *It melts also in the cold, when there is frost.*

The knowledge of the tin disease is no more modern than the knowledge of most other diseases.

In this connection it is interesting to speculate on the antiquity of the use of tin. This metal is one of the easiest to obtain from its ores, and may have been used far earlier in the history of mankind than is generally supposed. Evidence in the form of utensils, etc., would of course have been destroyed by the tin disease.

We are indebted to the investigations of Professor Cohen for a more striking example of a metastable metal, that of the "explosive" antimony. By passing an electric current through a solution of antimony chloride this metal may be deposited on platinum in the form of a thick metallic coating. This electrolytic antimony is in the metastable condition exhibiting the same state of passive resistance towards change as the metastable sulphur, sodium acetate and water. If scratched with a file it changes to the stable form of antimony with explosive violence, heat is given off and dense clouds of whitish vapor are evolved. The metal has changed to the ordinary antimony, used so much in manufacturing as a basis for bearing metals. The method of bringing this change about and the velocity of transformation reminds one forcibly of the transition of undercooled water to the stable form.

That many other metals have the property of existing in the metastable state is highly probable. In this connection the hardening of steel is of especial interest, particularly so since the manufacture of steel has played so important a rôle in the advance of civilization. The method of tempering steel has been the subject of numerous trade secrets. In a book of recipes published in the sixteenth century the reader is told that steel may be hardened by quenching it in rain water in which snails have been boiled; also that

> Ye may do the like with the blood of a young man XXX years of age, and of a sanguine complection, being of a merry nature and pleasant . . ., distilled in the middst of May.

Fortunately for this type of young man the modern steel manufacturer uses other methods for hardening steel.

The discovery of hardening steel by the quenching process is of course as much of a mystery as the method of raising bread by fermentation, we only know that it is an ancient process and moreover of great interest from the standpoint of delayed transformations.

If the alloy that we call steel is taken at a high temperature and allowed to cool very slowly it becomes soft and tools made from it will not have a cutting edge. Sudden chilling, however, produces in the metal a decided hardness. The results obtained by different rates of cooling have

been explained by the investigations of the last few years. When cooled slowly the steel undergoes a transformation changing to a form very much softer than that which existed at a higher temperature. If chilled suddenly the steel remains in the same form that was stable at high temperatures, consequently the property of hardness is retained. Here again the analogy to the other cases of delayed transformation is evident, for the quenched steel is exhibiting the same state of passive resistance as the white tin that remains unchanged at a temperature below 18°. Now since the tin is not permanent under those conditions the question occurs to us, does steel slowly return to the stable form and thus in time grow softer? That we do not know; we can only say that if such a change does take place hundreds of years are necessary to bring it about. Japanese swords hardened in this way and made as far back as the fifteenth century when carefully preserved are apparently as hard as ever. If, however, this kind of steel is heated to the temperature of boiling water it gradually softens, reverting to the stable form. And if heated to 150° the softening takes place in a very few minutes.

From these examples of retarded transformation an idea of the extent and the importance of this phenomenon in the physical sciences may be obtained. New cases are constantly being discovered, in fact, the reluctance of substances to assume a new state seems to be pretty general. And as it so often happens in science that discoveries which seem at first to be of theoretical importance only, ultimately are shown to be intensely practical, so the study of this phenomenon has cleared up the mystery of the tin pest and promises to be of great importance in the study of metallurgy and many other branches of applied chemistry.

# HEREDITY, CULPABILITY, PRAISEWORTHINESS, PUNISHMENT AND REWARD

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MODERN studies in heredity are yielding results whose social bearings can not be overestimated; and of these bearings not the least significant are those that relate to responsibility. To make these bearings clear we have, first of all, to grasp the current views about man.

It is often stated that man is a gregarious species; this illustrates the old point of view. Now we say: "Man is a congeries of elementary species or *biotypes* and hybrids between such; and some or most of these biotypes are gregarious." It is the necessary abandonment of the view that mankind is fundamentally uniform and homogeneous that involves such a change of our fundamental conceptions. There is, indeed, no statement that can be made about man that is universally true; and here is where our social codes, our laws, our works on ethics find their real limitations. We hear it said: "Human nature is pretty much the same the world over"—yes, in its *variety*.

Let us consider some of the evidence for such biotypes in man. Every one is familiar with the ordinary anthropological races; the white-skinned, black-skinned, brown-skinned, yellow-skinned and red-skinned. And inside each of these races no less marked subraces or strains may be distinguished. Take the white race alone. There are the blue-eyed subrace of Scandinavia and the brown-eyed subrace of the Mediterranean coast; the straight-haired western Finns and the curly-haired strains found in spots of Scotland; the tall strain of Ayrshire and Galloway and the short strain of Polish Jews; the dolicocephalic Corsicans and the brachycephalic Dalmatians. Coming to America we find, similarly, in southern California that a subrace that is nonresistant to tuberculosis and bronchitis has been partially segregated; in a valley of the Berkshire Mountains is isolated a nearly pure strain of feeble-mindedness, including much epilepsy and migraine; in eastern Massachusetts is a partially pure strain of deaf-mutism. We have evidence of localities (frequently much inbred) where are being isolated more or less pure-bred strains of albinos, of dwarfs, of syndactyls and polydactyls, of the non-resistant to cancer, of myopics, of hermaphrodites, of melancholics, of eminent scholars (*e. g.*, the Dwight-Edwards-Woolsey complex of the Connecticut Valley), of military men and statesmen (*e. g.*, the "first families" of Virginia), of sea captains and naval officers (*e. g.*, the Hull-Foote family of Connecticut) and so on. Such "families" have just the same

biological significance as the blue-eyed or long-headed races; they are properly called biotypes. If some of these biotypes do not persist for more than a few generations it is because of the constant cross-breeding that is going on between biotypes. When a blue-eyed Irish girl marries a south Italian the children are all brown-eyed—the potential blue-eyed biotype is brought to an end by hybridization. So when a great color artist marries a woman who belongs to a non-artistic family the children may not belong to the artistic biotype; but, under appropriate matings, the characteristic of the biotype may reappear in later generations.

The objection is raised to this view that it overlooks the importance of opportunity in determining the vocation in which one finds success. This objection is founded on the fundamental theory that all men have equal capacities for all things and the reason why one person succeeds in one occupation and another in a different occupation is because they have different opportunities. And the objection vanishes when this theory falls. A year in a Berlin conservatory of music would be a great opportunity for some people; but not for me. How often is the dearest wish of a man to have his son take up the profession in which he himself has succeeded frustrated by the son's entire lack of taste or capacity for such a profession. "Opportunity" assumes an innate capacity for taking advantage of it. Hence, those who have had a "superior opportunity" must have had a germ plasm specially adapted thereto. Those who regret a lack of early opportunities really (within limits) regret their inability to respond more adequately to such stimuli—such culture —as came to them. Now, "all men" are born into thousands of distinct biotypes and what is true of those of one biotype is not true of others. A single standard "before the law" is as unbiological as it is cruel.

Consideration of the inequalities of persons "before the law" involves an examination of the foundations of law and society. Again and again, in various parts of the world, men have come together in communal life for physical and moral support, responding to a gregarious instinct. A leader is selected to enforce these communal customs that past experiences have proved to be favorable to the community. Moral law is merely this: behavior that is favorable for the specific community is "good"; behavior that is harmful for the community is "bad." Good and bad thus refer to conduct which is judged in its relation to the experiences, traditions and ideals of the given community.

Now, conduct is reaction to a stimulus; what the reaction shall be depends not only on the stimulus, but also on the nature of the reacting protoplasm; particularly, in man, of the senso-neuro-muscular complex. While in the young the relation of stimulus to reaction is relatively simple, during development there appears, most markedly in gregarious

species, an inhibitory mechanism by which the expected reaction may be stopped. The inhibitory mechanism (aside from its usefulness to the individual) is a device for protecting the community from reactions that, however favorable originally to the individual, are antisocial. Children at birth have the inhibitors undeveloped, but they have a marvelous capacity for acquiring them in some or all forms. Many a person, however, unfortunately for himself and society, is incapable of acquiring the full complement of them; he tends constantly or periodically, throughout life and despite the best training, to react directly to the stimulus that falls upon him, antisocial though the reaction may be. Such a person may have perfect "society manners" and be faithful in conjugal relations but on occasion will take from shops articles for which she has no need; or another is regarded as a valuable member of his community, a leading member of the bar and a pillar of the church, but about once a year consumes a nearly lethal quantity of alcoholic drinks; or another is an agreeable, generous, affectionate young fellow who, about once a month, secretly sets fire to buildings in order to feed an irresistible love of the excitement produced by the flames; or a young girl who does well at school starts out from a comfortable home ostensibly to go to Sunday School, but makes it a practise of spending the afternoon in the rooms of some marines; or a lad of refined home, beloved of his parents and loving them, slips out of doors instead of going to bed at night and sleeps in entry ways or wanders out into the country and spends the night in a barn. These are examples, among hundreds that could be cited, of a lack of specific inhibitions. The stimulus can not be shunted off; it must lead to the specific response. Just as the amœba throws out its pseudopods along the path of the incident ray and so moves from the source of light; as the moth flies towards the candle; as the carrion fly is directed in its movements by the scent wafted to it from afar, so such persons perform their unsocial acts as part of their necessary reactions.

In another set of cases every reaction to a stimulus is of a socially desirable sort. All desires for the property of others, all inclinations to avenge insult by violence, all tastes and appetites, including the sex instinct, are readily inhibited—are under perfect control. And why are they under control? Because, first, the person who has the inhibitors came from a fertilized egg that carried the determiners for them; and, secondly, was surrounded by influences that were favorable to their development. In what sense can these people be held to be equal before the law with those considered in the preceding paragraph?

Even in numerous elements of mood and behavior the influence of the hereditary make-up is striking. One person is prevailingly elated, jovial, irrepressible; another quiet, depressed, melancholic; another, still, alternates in these moods and when elated he believes he can do

anything, but when depressed a sense of helplessness overpowers him. Again, one person is original and independent while another is always imitative. Here is a famous lecturer who has quelled mobs with his eloquence but who is prevailingly diffident; while there is a woman who has lived always in the backwoods and is as forward as a Canada Jay. Sincerity or insincerity, generosity or stinginess, gregariousness or seclusiveness, truthfulness or untruthfulness, are all qualities whose presence or absence is determined largely by the factor of heredity. The way a person reacts to a given stimulation is, thus, determined by the germinal determinants that have fallen to his lot and the training and experience that have favored or repressed the complete development and fruition of such determiners. The self-control which he realizes he is exercising at any moment is a part of his involuntary reaction. And the individual can no more alter his reaction than he can pull himself up by his boot-straps.

How opposed is the conclusion, to which we seem logically forced, to the theory of organized society as carried out in its laws and in its treatment of persons. Here are two men, one whose reactions are all social; the other whose reactions are prevailingly antisocial. The first we praise, we heap with honors, we supply with the good things of life. The other we condemn, we hold him culpable, we confine him to a cell seven feet by four with little air and less daylight, and we feed him with the poorest food. We are rewarding the one and "punishing" the other. Yet each has turned out the necessary product of his own organism under the conditions in which it has developed. Neither exercised any selection of the elementary constitution of his organism, which was decided at the time the two germ cells united; neither had any control over the conditions of early development of the determiners, over his early education and the development of the germs, if any, of inhibitions. If the reactions of the organism are socially "good," fortunate that person; if he "elects" to study hard and prolong his education he does so because of a liking or ambition for which he is in no way responsible. Society does well to care for the good organism, to preserve it from overwork, from accident, from corroding influences. If, on the other hand, the reactions of the organism are socially "bad," unfortunate that person; if he "selects" bad companions and runs away from school, his reaction is in such case a necessary consequence of his make up. Society does well to restrict the product of the bad organism, protect society from it, or, if it seems best, to send it to the scrap heap. No doubt there are persons who are trainable, but have not had their inhibitions cultivated. It is sometimes possible to develop these dormant germs even relatively late in life. The infliction of pain is occasionally of educative value even in youth at the age of puberty. In other words punishment for crime may have, in some cases, a deter-

rent effect. But to punish the organism for an anti-social or "bad" reaction just because it is "bad" and in proportion to its badness (as we habitually do in the courts) is just as reasonable as the act of the little child who flogs his broken hobby horse because it no longer goes.

When a crime is committed society's first query is: Who is culpable? Let us find him and he shall be punished. The police officer bribed the gunman to slay the Jew. Who is culpable? The gunman? He reacted to the bribe in a fashion that was predetermined from his make-up and training. In his sordid way the policeman knew whom he could bribe. We can not blame the gunman any more than we blame the tiger. The police officer, then? No, he reacted to the stimulus of greed and fear that was predetermined from his make-up and training; the bear at bay would do the same. The responsibility goes back to society that permits the combinations to be made that react in this fashion and after such combinations are made fails to protect itself against their reactions. But, if these offenders are not culpable may they not be freed? By no means. These organisms are, as their product proves, bad; send them to the scrap heap. In general, if the trespasser has been apprehended, consider both the stimulus and the reaction. If it appears probable that there are undeveloped inhibitors the state should supply the training that may develop them. If not, the person should be permanently segregated from society, while his life should be made as happy and useful as possible; or else he should be entirely cut off. Especially should he not be permitted to reproduce his defects.

A word as to the rewards that society gives to those who are its effective and good members. Wages, salaries, profits, honors are such rewards. Because I am only half as good to society as another I get only half the reward. May I therefore complain? No, society is justified in making distinctions in its rewards. But I have no claim on a reward for attaining which I have done nothing except what I could not help doing; that I am good in any degree is no virtue of *mine*. Yet, from another point of view, the organism that is I has a virtue in so far as it reacts socially, and it may well call society's attention to the importance to society of its output and, in that measure, of the importance to society that it should be adequately supported. The man who invented a machine for making horseshoe nails made a fortune out of it, but he had no claim to that fortune; his germ-plasm had the determiners for inventiveness—his father also made machinery and was even interested in horseshoe nails. Society should certainly see that so good an inventor is properly supported. Indeed, society should see that the prize of special reward is held up before those who need its stimulus; but society may well fix a limit to such special rewards and not permit profits beyond such a limit. The successful lawyer and physician have no absolute claim to their large fees. Society in general recognizes the

value of their reactions and wants to see the reacting organism adequately sustained. That boldness, swiftness, certainty of manipulation and that precise knowledge which belong to the great surgeon are not due to himself, but were, in their elements, antecedent to him. He could not help his valuable innate qualities, his knowledge is largely a heritage of the past, his education has been possible because of his educability and because of preexisting knowledge. He can not base his claim for a large fee on any virtue for which he is responsible; but only on the ground that society should adequately sustain his obviously "good" organism. Of the question, in what that adequacy consists, society must be the final arbiter.

Thus the recognition of the part that heredity plays in determining human behavior leads us to see more clearly how secondary the individual is to society, leads us to avoid placing "blame" on the bad and fulsome praise on the good, leads us to recognize the true worth and the real limitations of education, religion and other good influences, and leads us to conclude that the greatest advance that humanity can make is to secure an increasing proportion of fit marriages producing the largest number of effective, socially good offspring to carry on the world's work.

So much I wrote last December and sent to the editor; but shortly after there appeared in *Science* (January 10) the address by Professor Edwin G. Conklin on "Heredity and Responsibility" and the editor suggested that, since Conklin's views and mine were not wholly in accord, that I should discuss our points of difference. Immersion in other work has caused a delay of four or five months.

For the most part Conklin and I are fundamentally in agreement. Certainly no farmer believes that the yield of his crop is predetermined in the seed he plants; nor are reactions controlled solely by one's germinal determiners. The most able artist needs training; but training is vain if there be no capacity whose development is to be cultivated. The importance of training, for the trainable, no one ranks higher than I. Thus I agree heartily with Conklin's statement:

> **The factors which determine behavior are not merely the present stimulus and the hereditary constitution, but also the experiences through which the organism has passed and the habits it has formed.**

Only I would add: The effect of the experiences and the capacity for forming habits are, to a degree, determined by the hereditary constitution; just as my bantam chicks develop into bantam hens no matter how well I feed them.

But in his discussion of responsibility I am able to detect a difference of opinion between my way of looking at things and Conklin's. When he says it is the duty of society to produce proper environmental

stimuli for the child I agree completely but when he states that we have half-used talents that we may greatly improve, I feel like adding "if only the proper stimulus is afforded" (such as Dr. Pepper afforded Dr. Conklin when Dr. Pepper reminded him that he *could* do what he *had* to do).

But in the last two paragraphs of his address Dr. Conklin's views diverge more widely from mine, and I confess I can not follow him. We are agreed that through bad environment or culture potential inhibitions may fail of development; but I can not see how a man is responsible for the consequences of this bad culture of inhibitions any more than he is for not knowing how to read if he has never been taught. And my reaction to his inquiry: "Is it not a fact that belief in our responsibility energizes our lives and gives vigor to our mental and moral fiber" would be a denial. The moral fiber of my dog leaves little to be desired, and there is much in the devotion of many an untaught denizen of Central Africa that can not be matched in the descendant of any Puritan; yet it is fair to doubt if their actions are energized by a "belief in their responsibility." I do not think that "shifting all responsibility from men to their heredity or to that part of their environment which is beyond their control helps to make them irresponsible" or alters to any appreciable degree their behavior; the Puritan will be a Puritan still; the wayward girl will be wayward still. My view is that a person really can not react otherwise than he does under the circumstances in which he finds himself placed; a person, therefore, who accepts the theory that he is not "responsible" can not fail to continue to react in the same old way; except in so far as the idea *may* cause him (if he reacts that way) to put himself in the way of getting his environment improved. If I am not (but others are) responsible for my conduct then I must seek good intellectual and moral influences. And if my neighbor is not responsible for his conduct, but I with others am, why then I must bestir myself to help train him and his children. Man has become in truth his brother's keeper. As the farmer cultivates his crops and rejoices to see them grow, so every man of us lends his service to the culture of his fellow men. But as the corn stalk is powerless in and of itself to add one kernel to its ear, as the spaniel can not train himself to become in any degree a terrier, so I can not find any mechanism in man by virtue of which he can react to a given stimulus in a way opposed to that indicated by his inherent traits and functions, including the culture that they have experienced during their development.

# GUSTAV THEODOR FECHNER

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SOMEWHERE Huxley says that certain men are counted great because they represent the actuality of their own age and mirror it as it is,

> Such a one was Voltaire, of whom it was said that he expressed everybody's thoughts better than anybody. But there are other men who are great because they embody the potentiality of their own day and magically reflect the future.

In both of these respects Gustav Theodor Fechner was one of the greatest men of his age and perhaps, as not a few psychologists feel, one of the greatest in the history of science.

But in reflecting the tendencies of his age Fechner's influence was less like that of a mirror than of a many-sided prism which bends and reflects light in all directions, sending it out tinged by the action of the medium through which it has passed. There are few divisions of the domain cultivated by natural science in the first half of the nineteenth century over which Fechner did not pass, and there are few on which he did not leave the imprint of his originality. In the second edition of the "Elements of Psychophysics," a work in which Fechner laid the foundations and built somewhat of the superstructure of the present science of psychology, the editor, Wundt of Leipzig, has appended a list of Fechner's published writings. Excluding editions other than the first, and including translations of physical and chemical works which with Fechner usually meant critical revisions, the list comprises 124 titles, and a classification of these under the headings of nonsensical, humorous, literary, chemical, physical, psychological, esthetic, statistical, physiological, encyclopædic, logical and philosophical, would perhaps more than anything else give a representative idea of Fechner's almost unparalleled many-sidedness.

His first published works were an inverted reflection of his university career as a student of medicine. The condition of medical study in the first quarter of the nineteenth century may be inferred from Fechner's objections to entering a profession in which he had taken his degree; although qualified by the examination to practise medicine, he remarks:

> I could neither open a blood vessel, apply a bandage nor perform the simplest obstetrical operation.

Accordingly, the first use he makes of his medical knowledge is to satirize, in the main, with kindly humor, the medical disciplines, especially the materia medica, of his own day. For the medicine of that time was still in the bonds of authority, it still harked back to Galen and Hippocrates, though, as Fechner remarked, it had become what its adherents called so "rational" in its methods, that had Hippocrates himself come up for a medical degree, he would have "fallen through" as not knowing Greek and as being unacquainted with the "Hippocratic method."

These first publications of Fechner appeared under the pseudonym of Dr. Mises—a *nom de plume* which he used for many years in connection with what he perhaps thought were the Fliegende Blätter of his scientific and literary activity. But in whatever he published—literary criticism, riddle books, psychological investigations or philosophical treatises—Dr. Mises is always a co-worker. In his last controversial writing, "On the Principles of Psychological Measurement and Weber's Law," a subject with about as much affinity for the humorous as a table of logarithms, it is Dr. Mises who begins the article with a quotation from Wieland:

> Noch einmal sattelt mir den Hippogryphen Ihr Musen
> Zum Ritt ins alte romantische Land,

and so he goes on to say,

> I once more saddle—and probably with my 86 years, it is for the last time —my war-horse for a ride into the romance land of Psychophysics.

It was indeed his last ride, for that volume of Wundt's "Philosophic Studies," which contains this article, also contains the funeral oration which Wundt delivered over Fechner's bier on the twenty-seventh of November, 1887.

But it is in the philosophical writings especially that it is at times not easy to distinguish between Dr. Mises and Fechner the philosopher, and it is the infusion of something dangerously akin to humor in the unconventional treatment of philosophic questions no less than a curious tendency towards a practical mysticism which made the cut and dried philosophers of Fechner's day shake their heads doubtfully at this philosophy which moreover was attached to no school and sprang from no accredited system.

It is perhaps not to be gainsaid that the fanciful Naturphilosophie of the early part of the nineteenth century for many years tinged faintly Fechner's speculative views, but it was too arbitrary in its methods and too vague in its conclusions to radically affect or infect a mind so incredibly ready as was Fechner's to submit its problems to the test of experiment. At any rate we find that in 1824 Fechner had undertaken the first of those translations of French physical and chemical text-books which busied him not a little in this period of his career.

The work translated was Biot's "Traité de Physique," and the budding scientist sagely questions

> If the Oken-Schelling Philosophy could have shown anything of that fine scientific correlation of optical phenomena which Biot presented with so much clearness.

What were the requirements for a lectureship in physics at Leipzig in the year of grace 1824, the writer can not say, but in that year, aged 23, Fechner began lecturing on that subject, his published work up to that time consisting of two essays by Dr. Mises, a cram-book of physiology and a text-book of logic for school use. But whatever Fechner's qualifications when he took the lectureship, he speedily became a skillful experimentalist and investigator. It was a time when the scattered observations in electricity and magnetism were beginning to be bound up into connected theory. In 1824 Oersted discovered the attraction of the galvanic current for the magnet; it was in this decade that Faraday was making his classical researches on the action of induced electric currents and that Ohm announced the famous law of electric force which bears his name. Into this broad and rapid scientific movement Fechner threw himself with all his tireless zeal, and excluding his translations of French chemical and physical works, published in the period between 1828 and 1848 no less than 21 investigations on electricity and magnetism, devoted mostly to testing the laws and theories of the electric current, especially the fundamental facts underlying the great law of Ohm. The generous equipment of ingenious apparatus, which we are wont to find in German laboratories, was wanting in Fechner's day, so that he had in these investigations to patch out his equipment at his own expense and often with home-made devices, but "despite these drawbacks," says his biographer, Kurd Lassowitz, himself a physicist, "he succeeded," through skillful and careful arrangements of his measurements, together with his tireless industry, in obtaining results of surprising accuracy, and Wundt testifies that, even to-day, Fechner's measurements of the galvanic battery may be safely commended to any one looking for a model of logical method in the domain of natural science.

But beside the electrical investigations, his activity in other kinds of work was unceasing; a bulky Haus Lexikon in 8 volumes, of which he wrote fully a third, a pharmaceutical journal, of which he was at once editor and chief contributor, so-called translations of which he was as much author as translator, text-books in physics and chemistry—his literary and scientific output in this period alone would have insured him no small amount of space in any future Haus or Konversations-Lexikon of his fatherland.

But the load was too heavy for him to carry, and the straw, or rather bale, which finally broke him down was the bulky Hauslexikon. In

1840 after premonitory symptoms of an overstrained nervous system, a three years' illness set in of so depressing, perhaps so desperate a character, that few could have weathered it and retained their reason.

His illness was partly physical, a distaste for food, and partly mental, a distaste for work—the more alarming symptom in a man of Fechner's natural activity—together with an inability to control the course of his ideas or even to distinguish between the real and the imaginary. Added to these evils there developed such a supersensitiveness of the eyes that for almost three years Fechner had to live in darkness. Without means and without earning power, tortured by physical pain, sitting in darkness, anticipating total blindness and perhaps insanity, it is small wonder that his thoughts turned again and again to suicide as the only source of escape from his woes. That Fechner did not put an end to his life is perhaps due to certain traits which were his, by right of inheritance from his father—an almost ideal representative of the high-minded, conscientious German village pastor—to wit, a keen sense of duty and a tough energy of will which set themselves against the unbridled flight of illusionary ideas. He wrote:

> For almost a year I struggled the greater part of each day to banish these ideas from my thoughts, and while this exercise served as a distraction, it was of the most painful nature that it was possible to conceive.

Few could have passed through an ordeal like this and have retained reason, and no one unchanged in his views of what makes life worth living; and so, when Fechner took up academic work again it was not with lectures on molar and molecular forces but with discourses on subjects of ethics, of psychophysics and of esthetics; "from the physicist had come forth the philosopher." But while his lectures were comparatively few in number and given seemingly as a quid pro quo for the 850 Thalers of salary allowed him yearly by the government during his illness, there was no falling off in his pristine zeal in speculation or industry in investigation.

Among Fechner's earliest writings, for which he made Dr. Mises sponsor, was a satire on the methods of reasoning of the natural philosophy of his day, entitled "The Comparative Anatomy of the Angels." Applying, for example, the much-used doctrine of continuity, he finds that the angels, as the highest and most perfect of created beings, can have no legs, for, "beginning with the lowest animals, we see the scolopenders have, God knows how many legs"; next above them come the butterflies and beetles with six; mammals have four; birds, which resemble angels in their free movement through space, together with human beings, who, by their own account are half animal, half angel, have but two. At each step towards angelism two legs disappear, with the step from man upwards all legs must have gone; ergo, angels have no legs. But this also follows *a priori:* for as the most perfect of created

beings, angels have the most perfect shape, which is acknowledged to be the sphere with its perfect legless symmetry. Again passing along in ascending order the series of sense organs of human beings, we go from crude mechanical touch and pressure up through taste, smell and sight, to the refinement of vision which is capable of reaction at measureless distances. From this and many other chains of ingenious reasoning Dr. Mises concluded that the eye is the propotype of the angel in form and function, and by other reasoning, equally ingenious, he finds that the planets are conscious beings, to wit, angels. In the "Zend Avesta," published in Fechner's fiftieth year, the jest of Dr. Misses has become a matter of serious earnest. The earth is a higher being, possessed of higher consciousness, the vehicle itself of human consciousness and the connecting link between man and God. Similarly the remaining planets are conscious beings, while, at the other end of the scale of existence, the planets also have consciousness.

Now looking at such utterances, as they stand by themselves, one would naturally suppose physicist had disappeared in the mystic, and that the laboratory had given place to the oracle. But if this was the madness of mysticism, there still remained signs that the old Fechnerian spirit was still alive, for in the succeeding year we find him engaged in counting the steps of men and women passing by his house to serve as material for a statistical study on the ratio of the masculine to the feminine steps, published by the Saxon Academy of Sciences. As a matter of fact the coming of the "Zend Avesta" had been foreshadowed sometime before Fechner's illness in a little work entitled, "Das Büchlein des Lebens nach dem Tode," dedicated to the daughters of a dear friend who had passed away. The little book is rather a message of comfort than a didactic sermon, but in the doctrine that the soul after death becomes diffused into the general consciousness of nature we have the seed that later developed into the remarkable system of Fechner's metaphysics.

But if consciousness is a general attribute of nature it must be shared by plants, and so we find that the first work written by Fechner after his illness was the "Nana or The Conscious Life of Plants," necessary prolegomena to the "Zend Avesta." When the greater part of Thoreau's Week on the "Concord and Merrimac Rivers" had been turned over to him by the publishers as a waste product, Thoreau is reported to have said he had a library of about a thousand volumes, over 900 of which he had written himself. Almost a like fate awaited Fechner's publications of this period and for reasons that are obvious; the physicists could but shake their heads at a colleague who had given up his exact investigations in order to urge the phantastic thesis of plant consciousness and the professional philosophers of that time were unable to reconcile the author of the psychophysics with the seer of the "Zendavesta."

But it was perhaps less the difference in value that he placed on the subjects of metaphysical speculation, than the different way in which he approached them that separates Fechner from the idealist of the early nineteenth century. Believing no less absolutely than Hegel, that the reality of the world must accord with what is reasonable, he saw clearly that this reality could not be deduced by dialectics, but that it must be worked out as one works out final questions in physics, namely, by generalization and by analogy. In other words the metaphysics of Fechner was an inductive metaphysics or "Metaphysik von Unten," as he enjoyed terming it, and as a philosophy of this kind must change with progress in positive science, it becomes a scientific philosophy, so that in this respect Fechner is the precursor of Lotze and Wundt. But it was chiefly with the weapon of analogy that Fechner attacked the problem of the ultimate nature of the cosmic world, and if in the history of philosophy, this logical weapon had ever before been used with such subtlety, such precision and with such bewildering variety of application the writer is unaware of it. The profusion of arguments in behalf of the thesis that plants have mental processes that differ in degree but not in kind from that of animals is overpowering and in many points unassailable, save by a fine old crusted prejudice against the doctrine in general, and whoever takes up the "Zend Avesta" with the expectation of finding there a mystic blend of "confusion, illusion and illation," will be speedily undeceived by the opening chapters which bear a closer resemblance to Newton's "Principia" than to the book of Revelations.

He asks, for example, that the scientific notion of force be extended from inorganic to organic matter, from physics to biology. For force in the scientific sense is not an immanent power residing in bodies by means of which they pull or push one another, but it is a simple phenomenon of motion, and is measured by rate of change of motion. Instead of saying "Here is a force at work" one should rather say "Here is a law of nature." This applies no less to growth of the cell than to atomic attraction and repulsion; to explain organic motion by an innate power of adaptation is logically as wrong as to attribute to the sun an innate gravitative force. In the case of combustion we have only to consider the direct interaction of the particles of the bodies present, but in organic bodies we have an extraordinary close and complicated combination of parts into a unity, so that the necessary change of the separate parts can only be determined with relation to the entire system.

The writer gives this not in any way as the beginning of an explanation of Fechner's metaphysics which would lead one far beyond the scope and limits on this paper, but merely as an illustration of the kind of argument to be met with in the "Zend Avesta," and to indicate how far removed in its methods was the "Philosophie von Unten" from the

systematic philosophy of the time, even as its source—the deeply religious turn of Fechner's nature had little place among the conventional philosophizing motives.

Incidentally it may be said that the publication of Fechner of a little volume of riddles in rhythm for children between the appearance of the "Zend Avesta" and the work on the plant soul may throw some light on the failure of the professorial absolute idealist to understand the nature of the versatile founder of the "Philosophie von Unten."

But the year 1848 was a very unfavorable one in Germany for the reception of a new philosophy, particularly for a philosophy to which it was so tempting to attach the tag of mysticism. The German folk, wearied with the pretensions and dialectics of the rationalistic philosophers, aroused by vital questions of constitutional government and interested in the vigorous growth of natural science, had no time to waste on such questions as the mentality of plants and planets; the shallow materialism of Vogt and Büchner seemed to fall in easily with current theories of physical science; as a verbal proposition it seemed much easier to understand the statement that the brain secretes thought as the liver secretes bile, than to work out Fechner's involved, if keen, reason in regard to the seat of the soul. And so the "Zend Avesta" rested quietly with the "Nana" on the book shelves of the publishers. But in no wise discouraged, Fechner once more attacked the question of the parallelism of soul and body as a special problem "von unten auf," and in 1859 published the famous treatise on psychophysics.

The motive for this work was to determine, if possible, exact relations existing between the mental acts, the "psyche," and the accompanying physical process, or, in short, to determine quantitative relations existing between mind and body. Considering the general disbelief in regard to the possibility of such determinations, which had been summed up by Kant in the dictum that psychology could never become a science because it could never be treated mathematically, Fechner's plan might reasonably be termed bold. But when one thinks of the practical difficulties of the undertaking that Fechner had to create new scientific concepts and name them, that he had to create and develop totally new methods of investigation and that he had to invent new apparatus or apply old to totally new uses, it might seem as if Fechner had passed from the region of the improbable to that of the impossible.

The occasion for the psychophysics was a simple investigation on our discriminative sensibility for lines and weights, made by the physiologist E. H. Weber, one of the "seven sages of Göttingen." Weber simply states that we have the power to distinguish between the lengths of two lines which are to each other as 39 to 40 and between weights with a ratio of 20 to 30. Moreover, these ratios are general, holding for centi-

meters or inches, and for pounds or ounces. Taking up these hints, Fechner ransacked the choir of heaven and the furniture of earth to see if this general relation which, with characteristic modesty, he called Weber's law, did not hold true for all kinds of impressions, for sounds, for colors, lights, temperature, short intervals of time; he even questioned if it did not hold for our feelings; in short, if it was not a fundamental law of human activity. With characteristic thoroughness he launched forth into new seas of experimentation. He tells us:

> For several years I considered it a daily task to experiment about an hour for the purpose of testing Weber's Law and for elaborating new methods of research.

This daily task consisted in "hefting" and comparing pairs of small weights, in analyzing out the multifarious factors involved in judgments of likeness or difference and in noting the results. In so far as Weber's law is concerned it can not be said that the outcome of this vast accumulation of data is decisive, but so far as regards the working out of psychophysical methods of measurement, the experimentation was extraordinarily fertile. For the development of the Fechnerian methods meant that Fechner had founded a new science and reared somewhat of its superstructure in a domain whose only uniformity seemed boundless variability, and that later psychology has failed to find either the universality or the exactness in Weber's law which Fechner hoped to show is assuredly a matter of small importance in comparison with the birth of a quantitative psychology.

In the latter part of the treatise Fechner passes over to discuss what he calls "Inner Psychophysics," and here we strike a mine of acute and subtle psychological observations on sleep and dreams, on hallucination and illusions, on memory and after-images from which most writers of text-books and no small number of investigators up to the present day have "lifted" no small amount of ore. Taken as a whole, from the first remarkable chapter, remarkable at that day, on the conservation of force, through the mathematical treatment of methods of "mental measurement" up to the final discussion of psychophysical motion, the "Psychophysik" is a work which in the library of science one need not fear to place on the same shelf with the "Origin of Species."

If the importance of a work is to be measured by the number and repute of its critics, Fechner had no longer any cause for feeling that his theories were of no significance to the learned world, for among the cloud of witnesses who rose up to testify against the "Psychophysik" we find the names of v. Helmholtz, Hering and Mach, and later Wundt and G. E. Müller of Göttingen. Indeed so acute and penetrating was the criticism of Müller, that Fechner was obliged to defend himself in a new work entitled "Revision of the Main Points of Psychophysics." Later on he wrote a sort of omnibus reply to all his critics and up to the

very year of his death he carried on the psychophysical war with unabated vigor. His last extensive article, written in his eighty-sixth year, was on "Weber's Law," and Wundt's judgment on it is that it was the clearest and most perfect presentation of the subject which Fechner had given in the course of his forty years work in psychophysics.

The seeming hopelessness of psychology as an exact science lies in the perplexing multiplicity of the variable factors perturbing every attempt to determine facts and laws—errors of memory, errors of observation, errors of contrast and expectation, the brood of errors hatched by the changing rhythms of attention—and it was to devise ways of sifting out these errors that Fechner for years devoted his tireless ingenuity. But a satisfactory treatment of such conditions means the accumulation of large numbers of observations, which in turn calls for statistical handling of the materials gathered. Here again Fechner's genius found a fresh field to cultivate, for in endeavoring to see if some general principles were not at work in shaping what may be broadly called esthetic proportions, such as those of picture frames, visiting cards, decorative crosses and the like, he found that these classes of objects varied in their dimensions like the variations in the sizes of races of men, species of animals, like variations in temperature and rainfall and countless other objects in art and nature termed by Fechner "Collective Objects," "Collective Gegenstände." Mathematical analysis of the data in this field resulted in the formulation of a branch of statistics or applied mathematics which has become exceedingly useful in working out biological problems. Nor did he rest here; keenly interested in art (he contributed five articles to the *cause célèbre* of the genuineness of the Holbein Madonna, Dresden *vs.* Darmstadt), he followed up his investigation on simple esthetic proportions with a general investigation on esthetic laws carried out in the spirit of the psychophysics "von unten auf" by observation and by experiment. And here be it said that if there is any trait of Fechner which amazes a student of his work more than aught else, it is his incredible ingenuity in applying experimentation to problems where no one dreamed that experiment could be applied. Well! "Kurz und gut." In his seventy-first year he published the "Vorschule der Aesthetik" in two volumes and therewith created the science of experimental esthetics—the third and last distinctive product of his creative genius. His last published work was a clever and witty critique of the Mendel Fountain in Leipzig.

What has so far been set down here got itself delivered substantially as it stands, some eleven years ago, on the occasion of the centennial of Fechner's birth. Since that time the tide of Fechner's fame has swollen until it has overflowed into the German popular magazines. The "Zend Avesta" has passed into the third edition, the soul-question

has been born again with no less than Friedric Paulsen as accoucheur. Ebbinghaus has dedicated to Fechner's memory his classical treatise on psychology, and Möbius, the neurologist of Leipzig, has commemorated him in a volume of medical essays. Külpe, the philosopher and psychologist of Bonn, has been unwearied in critical appreciation of Fechner's achievements, and William James, who twenty-five years ago gave his official opinion that the "proper psychological outcome of Fechner's work was "just nothing," has made the *amende honorable* in a generously sympathetic essay in the "Pluralistic Universe." In glancing over the earlier pages of the present paper, the writer had the feeling that it resembled more a card catalogue of Fechner's publications than an appreciation of his work and works. If so, the fault lies somewhat in the faceted many-sidedness of Fechner's activities, as well as in the writer's deficiencies in power of interpretation. Perhaps the perspective of time now reaches far enough for us to view the outline of what he wrought in fairly true proportions. If so, one may say in brief that, able and ingenious physicist as he was it is doubtful if he could ever have risen to the stature of a Faraday; his philosophy will perhaps attract mainly those rare minds who, while working officially by the pale cold light of the intellect, are still prone to follow the promptings of the spirit into regions lying beyond the pale of syllogistic reasoning. His more solid and probably lasting achievements belong to the latter half of his life, to the period of the "Psychophysics" and the "Aesthetics."

As for the daily life itself, it was outwardly singularly uneventful even for a German "Gelehrter." He rarely left Leipzig, but, year in and year out, conscientiously fulfilled within its walls the duties of a public-spirited citizen. And the city responded by awarding him in his middle age an honorary citizenship, and at his death, with rare municipal good taste, erected a modest bust to his memory at the very turn of one of the winding walks in the Rosenthal where he had passed many a sunny afternoon of the long German summer days, discoursing with his friends on things that are little dreamed of by many a school philosopher. In accord with his scanty means was his dwelling in the Dresdener Strasse, fittingly called a nest; his study was furnished with a chair, a table, a stove and some bookshelves; a catalogue of the library resting on the shelves would usually indicate a stack of manuscript and a table of logarithms: sonst Nichts. Here there passed quietly away on the nineteenth day of November, 1887, almost exactly twenty-five years ago, the philosopher, the art critic, the humorist, the mathematician, the friend of children, the creative genius in science, Gustav Theodor Fechner. Verily, as Wundt said, in the funeral oration, "we shall not look upon his like again."

# THE INTELLECTUAL AND THE PHYSICAL LIFE

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NEW HAVEN NORMAL SCHOOL OF GYMNASTICS

THE notion is common and deeply rooted that men of large achievement, especially in letters or art, were physically inferior if not downright sickly and infirm. If one questions this idea, he is informed at once that Stevenson was far from well or vigorous, that Heine lived in a "mattress grave," that Chopin died of consumption at an early age, and that Darwin was hardly better than an invalid for much of his life. Even great military minds have found lodgment in miserable shacks of bodies, and Macaulay tells us that, at the battle of Landen, probably the feeblest persons present were the "hunchback" duke of Luxemburg and "that asthmatic skeleton," the Prince of Orange.

The evidence is very striking and also appealing, for while the sickly mediocre are not especially interesting to any one, the fine qualities of the sickly great are magnified, through our sympathy, by the infirmities which beset their paths. The genius displayed by such is often given more credit on this account than it in cold blood deserves. For example, Stevenson, though a writer of delightful things, does not seem by any means certain of maintaining the high place in literature awarded by the admirers of his personality. Heine, brilliant as he was, does not rank with Goethe; and Chopin, though unique in his way, is master in a comparatively narrow field. We should sadly miss his exquisite tone arabesques, but we never expect from him the sublimities of Beethoven or Brahms.

Of the notables named above, it might be remembered that one, Heine, did not complain of a serious illness until he was thirty-nine and that his paralysis was not confirmed until he was forty-seven; that Darwin also was in good health until he had returned from the voyage of the *Beagle* and was fairly launched in his life work; and that the leaders at the battle of Landen, while frail and sickly, were yet able to knock about on many fields of battle. Even of Stevenson it is said by Mr. Balfour that, "considering his fragility, his muscular strength was considerable and his constitution clearly had great powers of resistance." But for his Bohemian ways and his utter disregard of the laws of bodily well-being, he might have had a much greater degree of health and comfort.

The examples given of great men who were invalids are not always so well chosen, and there is often a tendency to exaggerate the infirmi-

ties of those named. For instance, Storrs in his life of St. Bernard informs us that the Hussite warrior Zizka was "half blind from his youth," and achieved his greatest victories after complete blindness came upon him. The truth is, Zizka had the use of but one eye in his earlier life, but as that, so far as we know, was a good one, he was a very long way from being half blind. He did win his greatest battles when totally blind, in his last three years, but he was necessarily surrounded, as every general must be, with faithful and sharp eyes in the heads of his lieutenants. Storr's other infirm hero is Doge Dandola, whom he describes as "blind and bearing the weight of almost a hundred winters when he stormed Constantinople." The Doge was eighty-four, which is some remove from a hundred years, and he was not blind at all. He was really an example of prolonged vigor.

Granting that there are wide deviations from the rule, we would set against the popular notion its antithesis that the intellectual life—that genius, to use that ill-defined but expressive word—is never at war with physical health and strength, but that, on the contrary, as a rule, the greatest men in all fields of endeavor have been lusty persons, and relatively free from serious or prolonged illness, and, where not robust, have usually shown wonderful vitality and powers of endurance. Moreover, they have, we believe, been more careful than the ordinary man to preserve their health, and have often husbanded their energy as the average mortal would not think worth his while.

Genius, of course, is no respecter of bodily tabernacles and takes up its tenancy in all manner of them, from the sickly and deformed to the most heroic and symmetrical, but its light will vary according to its conditions of bodily housing, as the light of a lamp will vary according as its wick is splashed at intervals with fuel of uncertain quality or is constantly bathed in pure oil. The mind of genius has its equally elaborate complement of brain machinery through which it expresses itself, but that brain mechanism depends in turn upon the rest of the body which elaborates, furnishes and keeps pure its supply of energy-material in the blood. It stands to reason that the more well ordered the body, the more active and vigorous will be the organ of the mind, and that anything which depresses the proper functioning of the physiological machinery must impair in so much the product of that organ, both in kind and amount. As there is no line to be drawn between genius and ordinary mental activity, what is true of one physiologically applies as well to the other.

It is quite true that accident or sickness often turns a man to a particular calling. Dickens was always thankful for an early illness which gave him a strong inclination to reading. Had Sir Walter Scott not been in childhood confined to bed with his diseased ankle, he might never have found introduction to the realm of romance which he later

revealed with such skill to the work-a-day world. It is not unlikely that he would have entered the army as did his son, and have furnished a mark for Napoleon's cannon.

In a profession where, until recently, its members have preached, even if they have not practised, the neglect and abuse of the body, one would expect to find many examples of the feeble and sickly who have risen to eminence, or who, in the course of an active, strenuous life, from their very attitude toward the body, have brought on ill health and weakness. Yet among the great religious leaders there have been many examples of fine bodily presence and especially of phenomenal energy and endurance. In an age of over-indulgence it is difficult to know just what the asceticism of the medieval monks amounted to, but even where, by their devotion to a mistaken ideal, the bodily machinery was undoubtedly more or less damaged, they often showed that they possessed a wonderful vitality and fund of nervous energy.

Among religionists St. Bernard is described as being, in early life, a man of fine presence; in later years he is pictured as "most delicate," without flesh. Those who knew his labors "felt as if in him a lamb had been harnessed to pull a plow." He was extremely ascetic, suicidally so, it would seem, as his friends had at one time to rescue him from himself and place him in the hands of a shepherd who taught him a few items of common sense. Nevertheless he is reputed to have surpassed robust men in his endurance, a trait readily attributed by his biographers to superior spirituality. Though strong enough for his monastic work, Bernard was undoubtedly physically unfit to lead the crusade which he preached, else he would not have refused the post. On the surface at least he does not appear to lend much support to our present thesis.

According to his half-legendary history, Francis of Assisi was a dashing young man who was turned from a life of frivolity to the religious life by a severe illness. There is no doubt but that St. Francis abused his body and lived the unsanitary life. His conscience must have smote him, for when he came to die at forty-five he begged pardon of "Brother Ass, the body," for having neglected him so shamefully.

The fiery Savanarola did nothing by halves, and we are told that, like Bernard, he was so severe in his mortifications of the flesh that "his superiors were frequently obliged to curb his zeal." There is no record of any sickness and notwithstanding his asceticism he must have been anything but weakly to the day of his martyrdom.

Luther, as a monk, apparently damaged his health by the overzealous mortification of the flesh. In his post-monkish days he perhaps went to the other extreme. He was apparently a very vigorous, active man until forty, when, doubtless from his too generous living, a troop of ailments settled upon him.

In Erasmus we have another example of the scholar of the cloister.

He was highly sensitive to physical influences. He could not bear the stoves of Germany, but required an open fire-place. He was hypersensitive to odors and delicate in his diet. He lived to be seventy despite attacks of gout and, as his days were crowded with work, he must have had a strong, though sensitive, constitution.

Of modern preachers, Robert Hall was a sufferer for years from renal colic, though he possessed great vitality. Jonathan Edwards was frail and Channing was not robust, but there is a numerous company who loom large in bodily impressiveness and health, and who show us the possibilities of the religious genius lodged in a fitting temple.

John Wesley "loved riding and walking, was an expert swimmer and enjoyed a game of tennis." His journal has been called "the most amazing record of human exertion ever penned by man." "On horseback he traveled more miles, spoke oftener and to more people than any man who ever lived." "Eight thousand miles was his annual record for many a long year, during each of which he seldom preached less frequently than five thousand times." At eighty he writes, "I find no more pain or bodily infirmities than at five and twenty," and he imputed this in part "to my still traveling four or five thousand miles a year and to my constant preaching."

Chalmers had a "great look" with his "large head, large chest, his amplitude in every way" and his "erect, royal air." He "had a frame of adamant, that bade defiance to the weather, and that actually exulted in the wildness of the blast" as he hurried over the moors. Spurgeon's body cast a shadow of no mean dimensions and he was in such vigor as to do an immense amount of work. Brooks was a man of great physique, who was so well that when taken with the grippe at fifty-five, he exhibited the impatience with sickness characteristic of one who has always been well by exclaiming, "How strange it all is, this being sick!" Beecher is another example of health and bodily vigor and it is interesting to note that it was his great maxim to keep his body "in first-rate working order, for he considers health to be a Christian duty, and rightly deems it impossible for any man to do justice to his mental faculties without at the same time attending to his physical powers." From Bernard to Beecher is a long interval of time, but a greater gap in ideas of the Christian life, and the last few examples prove that bodily abuse is not essential to spiritual power.

Among artists Leonardo, Raphael and Michelangelo would hardly be denied first place, and a second, later trio, Titian, Rubens and Turner, would rank very high. Raphael died at thirty-seven. He was beautiful, with an almost delicate face, but there is no history of sickness or any bodily weakness. Just prior to his sudden death from plague he had entered into a contract for an arduous piece of work. Leonardo, "painter, sculptor, architect, musician, mechanical engineer

and natural philosopher," was a person of splendid physique "who outstripped all the youth of the city in feats of strength and horsemanship," and who was "zealous in labor above all men, with a strength more than human."

Michelangelo was almost as ascetic in his habits as a monk and he labored with "furious" intensity, with chisel and brush, up to his seventieth year, when he still had energy left to plan and carry forward such great architectural works as St. Peter's. Even in his last year he is described as "healthy above all things," notwithstanding the storm and stress of adverse circumstances against which he had to contend throughout life.

It was said of Titian that his death from plague came (at the age of ninety-nine) as a surprise to his friends, since he lived "a life so strong and resisting that it seemed able to withstand all the assaults of time."

Rubens lived sparingly and was devoted to horseback riding. Despite bodily care he suffered from attacks of gout, so common in that age. It was not, however, until in his fifty-seventh year, when his attacks became more severe, that he had to adopt the use of the mahl stick in painting, a utensil which few painters have sufficient nerve control to do without at any time. The fact that "not the remotest trace of approaching old age, not the slightest failing of mind or skill, can be detected even in his latest works" testifies that he had not declined up to his sixty-third year.

Of Turner, the last of this sextette of artists, we know that his health was perfectly sound, that he walked his twenty miles or more a day with ease, often sketching as he walked. He could work fifteen hours at a stretch without weariness, and his digestion was so vigorous that all extremes of living were alike to him. He "worked harder and produced more than any artist of whom we have any record." As Hamerton said, "Man is an intelligence served by organs and few intelligences have been better or more regularly served than Turner. His nervous system was so sound that he could work anywhere and everywhere." At the age of sixty-seven he had an illness, but it was not until seventy that we "are sure that he declined as an artist, . . . when his health and with it, in a degree, his mind, failed suddenly."

Among musicians we have no trouble in selecting the greatest. All others stand on a lower plane than Bach, Beethoven and Brahms. Those who mark the physical imperfections of men of genius will at once say that Bach was blind and Beethoven deaf. Bach did become blind at sixty-eight, after such severe use as perhaps no other eyes ever received, and Beethoven (strange fate) did become deaf, his affliction beginning at twenty-eight years. This terrible defect undoubtedly

affected his general health materially, though his vigor seemed little impaired.

Up to the time of his failing sight, in 1747, we have no record of any sickness of Bach, while his untiring energy, as shown in his vast amount of work, bears sufficient testimony to his great vitality. He was able to be, besides a marvelous maker of music, "a particularly excellent father (he had nineteen children), friend and citizen."

Of Beethoven it is sufficient to know that he was spoken of as the "image of strength," as power personified—that there was concentrated in him "the pluck of twenty battalions." He was a great walker, and no day in Vienna, however busy or stormy, passed without its constitutional, "a walk, or rather run, twice round the ramparts . . . or further into the environs." Notwithstanding the constant effect of his deafness and the fact that digestive disturbances early began to keep him company, "his splendid constitution and extreme fondness for the open air counteracted his physical defects and even in his last illness" "his constitution, powerful as that of a giant, blocked the gates against death for nearly three months" and during the struggle his fancy seemed to soar more vigorously than ever.

Of the third of the great B's, Brahms, burly, well-knit, muscular, the "very image of strength and vigor," there is little to say beyond the fact that he was never sick. Widmann says "he displayed an absence of physical sensitiveness of which few could boast." "His constitution was thoroughly sound, the most strenuous mental exertion scarcely fatiguing him," and he could "go soundly to sleep at any hour of the day he pleased." Like Beethoven, Brahms was a lover of nature and a tireless walker.

If we step down from the company of the greater to that of the lesser gods of music, Mozart, Weber and Chopin are presented by the advocates of the feebler life for genius. Chopin we have already mentioned. Weber was weakly and tuberculous. With health and strength he might have equaled Beethoven. Mozart, though of inferior bodily presence, did a lifetime's work before his early death from typhus fever. He was trained by his father to take care of himself and would probably have lived the allotted time but for the stress of want, and overwork for thankless and unremunerative patrons.

Over against these few exceptions we could set quite a company of master musicians full of health and vigor. Handel and Haydn with their "continuous, sunny healthfulness." Spohr, "of sound health and herculean frame," his life filled with uninterrupted success and honors up to seventy years.

Then there was Wagner, "the best tumbler and somersault-turner of the large Dresden school," an adept at every form of bodily exercise, who "still performed boyish tricks (such as standing on his head)

when nearing three score and ten." Despite dyspepsia and a susceptibility to erysipelas he always possessed "an unusual amount of physical energy." Verdi is another example—the old-man-progressive produced his greatest works after he was seventy, his "Otello" being first performed when he was eighty.

The executive musician especially needs a good physical balance, for the strain upon his nervous system is very great. We find no invalids in the list of great singers. Liszt, Rubinstein and Paderewski were physically strong and robust, while Joachim and Ole Bull were men of long, healthful and vigorous life. A partial exception to the rule is met with in that strange personage Paganini, the severity of whose early training damaged an already frail constitution. He was extremely temperate and had a marvelous use of muscle and nerve in the weaving of his musical magic. He died at fifty-six.

When it comes to the philosophers, among the ancients we must include Socrates, Plato and Aristotle. From what has come down to us we know that Socrates served as a hoplite, or heavy foot soldier, and that in more than one campaign he was conspicuous for both bravery and endurance. He was short, thick-necked and corpulent, although thoroughly schooled to temperance. He was evidently as finely robust physically as morally, until his untimely death at the age of sixty-six.

Of Plato we are positive only that he lived to be seventy years of age. From his writings we know how greatly he appreciated bodily development and well-working.

Of the details of Aristotle's life we know little, but there is no evidence to signify that he was not always in at least fair health, and it would seem from the amount of his work that he must have been a man of great vitality.

Philosophy does not seem to have agreed so well with the moderns, and it seems to have fitted better into inferior somatic conditions than a combination of brain and handiwork as in the artists and musicians. Hobbes was an enthusiastic tennis player until beyond seventy and wielded his pen vigorously after he was ninety. J. S. Mill was "healthy and high spirited." Comte, Leibnitz, and, after his youth, Descartes, were all in fair health and strength, but Locke, Spinoza and Kant could not boast such physique. Of the three, Spinoza alone was short lived, Locke living to the age of seventy-two and Kant to that of eighty.

Spinoza, always of delicate constitution, was early afflicted with pulmonary disease and suffered also from ague. He was extremely abstemious, which did not tend to improve his condition, but it was not until he was forty that he became a confirmed invalid. In Locke's case prudent habits seem to have kept a delicate constitution in even balance of health up to the age of thirty-five, but from this time on, with all his care of himself, he was seriously handicapped by complicated and

increasing infirmities, chief of which were "chronic consumption and asthma." All this "painfully impeded his schemes of work and occasionally induced states of mind altogether at variance with its otherwise robust character." He was twenty years in writing his famous "Essay on the Human Understanding" and it was done "by incoherent parcels and after long intervals of neglect." No man was ever more impressed with the value of health and vigor and his "Thoughts on Education" begin with the bitter words, "Our clay cottage is not to be neglected"—for "he whose body is crazy and feeble will never be able to advance in it."

Immanuel Kant is a shining example of what can be done in economizing the bodily forces, and of how much may be accomplished in the way of mental work by a frail body which is kept in a fair state of health. "Possibly a more meager, arid, parched anatomy of a man has not appeared upon this earth." "His organization was so delicate that he was extremely sensitive to impressions from external objects, and Jachmann relates that a newspaper fresh from the press and still damp would give him a cold." "His digestive organs were early deranged and gave him perpetual trouble." Yet he said of himself that he was healthy, "that is in my usual weak way." If we can trust DeQuincy, "Kant's health was even exquisite." That "weak way" interfered with his work and he exclaimed: "Think of it, friends! Sixty years old, constantly disturbed by indisposition in plans only half completed." "He spoke of himself often under the figure of a gymnastic artist, who had continued for nearly fourscore years to support himself upon the slack rope of life without once swerving to the right or to the left." We owe to Kant's clock-work regularity and temperance of living the product which his fine brain produced, and his vast influence upon the world.

Herbert Spencer is another example of a philosopher who is put down as an invalid, and invalid he was for the greater part of his life after thirty-five. At thirteen he became homesick at school and started one morning at six for home; walked forty-eight miles the first day, forty-seven the second and twenty miles the third day, and in the whole time had very little to eat. It would seem that only a child of very remarkable vitality could have carried out such a program and survived. As he himself says, "It can scarcely be doubted that my system received a detrimental shock . . . although there was no manifest sign of mischief." As a boy he excelled in running and was a good skater.

At sixteen he speaks of himself as "strong, in good health, and of good stature," but easily excited and kept awake.

At twenty-one as a draughtsman he worked from eight in the morning to twelve at night and one day a week to three A.M. Keeping these hours, either with his routine or literary work, he found him-

self at twenty-eight becoming sleepless. At thirty-five "the mischief had been done." "His nervous system finally gave way." A night of sound sleep became unknown to him, while distress in the head and dyspepsia kept him company the remaining days of his life. Still, it must be kept in mind that even at sixty he writes, "My vigour is pretty well shown by the fact that I found myself running up stairs two steps at a time" and "it seems remarkable, considering my frequent bouts of dyspepsia and perpetual bad nights, I should have retained so much vitality." It was only between sixty-two and sixty-nine that he could truly be called an invalid with a capacity of only a few lines of work per day.

The work of science has often been carried on by men in not the best of health, nor of especial vigor. It has also so fascinated many of its disciples as to lead to bodily unbalancing from over-application to a sedentary calling. Galileo did an enormous amount of work, but his health was sometimes indifferent and he suffered from a number of illnesses. Darwin inherited a strong constitution and up to his voyage on the *Beagle* was "well, and vigorous and passionately fond of outdoor sport." His chronic nervous weakness seems to have been brought on by the privations and over-exertions of the five years' journey of exploration. By careful limitation of work and removal of unnecessary distractions, he lived to a good age, and accomplished a large amount of work.

Sir Isaac Newton was in fair health most of his days, though, from excessive mental work and absent-mindedness about eating, he had a nervous breakdown at fifty-four from which he was some months in recovering.

Franklin was proud of his physical attainments. "He was as temperate as it was possible to be in that age." He was an expert swimmer and at eighty he was fond of displaying his strength. He nearly died from attacks of pleurisy, and late in life he fell a victim to the diseases of the age—gout and stone. On the whole, Franklin throughout a long life may be considered an unusually vigorous and healthy person.

Huxley, strong and vigorous, worked at a terrible pressure and wore out before his time, but there have been many other scientists of note whose health was more constant, as Faraday, Tyndall, Agassiz and Lord Kelvin.

When it comes to men of letters, it would seem that health and vigor might be less frequent. The conventional poet, like his verses, seems a part of the world immaterial, until we become intimately acquainted with him and find that he too lives on bread and butter, beefsteak and onions.

Of the dramatists, Shakespeare, for aught we know, was reasonably healthy and vigorous. Molière led a busy, combative existence. Play-

houses were even worse in hygienic conditions then than now, and cold and fatigue seem to have injured his health. He continued his acting and writing with scarce abated vigor until his fifty-fourth year, when, just after playing the part of the invalid in the "Imaginary Invalid," he burst a blood vessel in a fit of coughing and did not survive more than half an hour. Molière was described as "neither too stout nor too thin, tall rather than short; he had a noble carriage, a good leg and his complexion was brown." This eye-witness saw nothing especially sickly or feeble about the great player and playwright. Goethe, great as scientist and novelist as well as poet—a universal genius—was likened in his youth to an Apollo. His frame was strong and muscular. In his mature years, Hufeland, one of the great physicians of the time said that "never did he meet with a man in whom bodily and mental organization were so perfect. Not only was the prodigious strength of vitality remarkable in him, but equally so the perfect balance of functions."

Goethe knew what sickness meant. From self-confessed youthful excesses ("However sound and strong one may be, in that accursed Leipzig one burns out as fast as a bad torch") he suffered some severe chest affection and he was for a time "uncertain whether he was not yet consumptive." In mature life he more than once suffered from renal colic and from rheumatism. Such attacks had but a transient effect, however, upon his wonderful physical make-up. He was a big eater, as have been so many great men (energy for work must be supplied by bread and butter) and he was a profound sleeper. Even when beyond the age of eighty he was still so vigorous as to produce truly remarkable works.

Of the personal history of Dante we know little, but he was evidently made of elastic stuff and we read of no sickness which came to him in his wanderings. He took part in the civil wars of his city. He died at fifty-six of a fever contracted in the lagoons of Venice.

Milton possessed a "peculiar grace of personal appearance." He seems to have been in good health up to about forty years, when he lost ground somewhat, and in later life, especially during his blindness, his health declined. Speaking for himself at forty-seven, he says: "Though thin, I was never deficient in courage or in strength." He exercised regularly with the broadsword and says he "was a match for any one." His blindness seemed to accompany the onset of gout, a disease hardly due in his case to intemperate living.

Of the great modern English poets, Tennyson was a man of splendid physique—"one of the finest-looking men in the world." In regard to his health he said of himself: "What my infirmities were I know not unless short sight and occasional hypochondria be infirmities."

Wordsworth, according to Hayden the artist, was of very fine heroic

proportions. He led a simple life and was healthy and vigorous. He was "as robust as one of the peasants of his native Cumberland." At sixty he walked fifteen to twenty miles a day; he was "still the crack skater on Rydal Lake, and, as to climbing mountains, the hardiest and youngest are yet hardly a match for him." Even at seventy-three he was "wonderfully well and full of vigor."

Browning had some headache, sore throat and colds, but his son wrote, "He was the healthiest man I ever knew," and another biographer called him "brilliantly healthy." Until past seventy he could take long walks without fatigue, and endure an amount of social and general physical strain which would have tried many younger men.

If we turn to the writers of what Dr. Johnson called "irregular and undigested pieces"—of essays—in the expectation of having only invalids for wielders of the pen, we find the inventor of this beautiful form of literature, Montaigne, speaks of his body as "strong and well knit." "My health is vigorous and sprightly, even to a well-advanced age, and I am rarely troubled with sickness." He considered health "the fairest and richest present that nature can make us." It was not a time of long living and Montaigne considered that he had reached a "well advanced age" when he had passed forty. At forty-five he became afflicted with stone in the bladder, which doubtless shortened the days of what was for him old age.

Bacon's health was always delicate. He speaks of himself as "a man of no great share of health, who must therefore lose much time." His nervous system seems to have been exceedingly sensitive and he swooned upon slight cause. By careful management of his health by the admirable rules he has laid down for others, he survived the storms of his political career and his friends expected for him a good old age. In his sixty-sixth year, when driving in London, he suddenly hit upon the notion of using snow as a preservative. He stopped his carriage, purchased a fowl and with his own hands stuffed it with snow. He was seized with a sudden chill, the cold and chill were succeeded by bronchitis, and he died within a few days. Bacon, like Kant, deserves to be remembered as one who lived his philosophy and who with small resource of vital energy kept that at its best and so made the most of the marvelously fine thinking machinery with which he was endowed.

The more modern essayists, Lamb and DeQuincy, did not present a very vigorous aspect. DeQuincy was, according to Carlyle, "one of the smallest man figures I ever saw . . . you would have taken him for the beautifullest little child." Yet he was not so frail even though small, and while hypersensitive to pain "he was wiry, and able to undergo a good deal of fatigue. Indeed he was a first-rate pedestrian, and kept himself well in exercise. He considered that fourteen miles a day was necessary for health. He never took cold, and even at

seventy he was active and vigorous." He easily outwalked James Hogg, who was much younger and who has been described as "hale and hearty as a mountain breeze." So much for this "invalid."

Lamb, who had "the appearance of an air-fed man and whose light frame" with its "almost immaterial legs" "seemed as if a breath would overthrow it," was spoken of as being "as wiry as an Arab," and Proctor said he "could walk during all the day."

In this list of worthies Carlyle and Doctor Johnson should have a place. The great lexicographer "in his bodily strength and stature has been compared to Polyphemus." Boswell speaks of his "herculean strength" and of his "robust health," which was not in the least affected by cold. His great appetite and his intemperance in tea have gone into history, but he could fast for two days without difficulty, and his frequent prayer was "that I may practice such temperance in Meat, Drink, and Sleep, and all bodily enjoyments as may fit me for the duties to which thou shalt call me." Notwithstanding his tendency to melancholia and some attacks of gout he was anything but an invalid.

The Seer of Chelsea was the descendant of a long line of "hardy and healthy Scottish dalesmen." He grew to manhood, he tells us, "healthy and hardy." It was not till after his twentieth year that "he became aware that he was the miserable owner of a diabolical arrangement called a stomach." From this time on he suffered from dyspepsia, headache and sleeplessness. He gave vent to his irritability by lamentations so grotesquely exaggerated as to make it difficult to estimate the real extent of the evil. According to Froude he had a Titanesque power of making mountains out of molehills. Notwithstanding his complaints he lived a vigorous, combative life to a good old age and even at eighty-two was able to walk over five miles a day.

Among novelists, Sir Walter accuses himself of perhaps "setting an undue value" on health and strength. For him "bodily health is the mainspring of the microcosm. . . . What poor things does a fever fit or an overflowing of bile make of the masters of creation?" He writes in his journal, "My early lameness considered, it was impossible for a man to have been stronger or more active than I have been, and that for twenty or thirty years. Seams will slit and elbows will out, quoth the tailor; and as I was fifty-four in August last, my mortal vestments are none of the newest." As a young man he was a desperate climber, a bold rider and a stout player at single-stick "and he walked twenty or thirty miles without fatigue, notwithstanding his limp." Attacks of rheumatism, renal colic and the awful burden of debt under which he toiled so heroically, finally overcame a constitution which, as he said, was "as strong as a team of horses."

Victor Hugo "was born with a thoroughly sound constitution"

and he was "in full vigor when many great intellects have passed into their decline."

Balzac "was eminently sound and healthy," "his whole person breathed intense vitality," yet those who were in the secret of his life asked with pitiful wonder how any man could find the time and physical endurance sufficient to support the enormous work of his "La Comédie Humaine."

Dumas's "health was well known and stood firm against the almost wanton test he imposed upon it." Such abuse plus the writing of "1,200 volumes" did not seem to impair his physical vigor until after his sixtieth year.

Thackeray was described in 1813 as "a stout, healthful, broad-shouldered specimen of a man." He knew no such thing as taking care of himself and suffered the consequences, though it took time to undo him. Edward Fitzgerald tells us how he wrote "reviews and newspapers all the morning; dining, drinking and talking of a night, managing to preserve a fresh color and perpetual flow of spirits under a wear and tear of thinking and feeding that would have knocked up all the other men I know two years ago at the least." Thackeray had the best medical advice, but, as he said, "What is the use of advice if you don't follow it? They tell me not to drink and I do drink. They tell me not to eat and I do eat. In short, I do everything I am not to do, and, therefore, what is to be expected?" Thackeray has the unenviable distinction of being one of the comparatively few men of genius who have undervalued health. He preferred, as he acknowledged in his exaggerated style, to "reel from dinner party to dinner party, to wallow in turtle, and to swim in claret and champagne." It is little wonder that the time came and came early (at fifty-one) when "he could not work at will"; when upon taking up his pen "his number of the magazine would not come."

In Dickens we have a man of superlative energy. After writing until twelve "he came out ready for a long walk . . . twelve, fifteen, even twenty miles a day were none too much for Dickens . . . swinging his blackthorn stick, his little figure sprang forward over the ground, and it took a practiced pair of legs to keep alongside of his voice." Dickens himself relates "a special feat of turning out of bed at two, after a hard day, pedestrian and otherwise, and walking thirty miles into the country for breakfast."

He was temperate in meats and drinks. James Fields said he had "rarely seen a man eat and drink less," but he was not temperate in his outlay of energy. As his self-chosen biographer said, "He never thought of husbanding his strength except to make fresh demands upon it," and besides, "his notion of finding rest from mental exertion

in as much bodily exertion of equal severity, continued with him to the last." All this was more than even Dickens could stand, and, as in the case of Thackeray, the machinery began early to show wear, though it was not until he was fifty-six that there was any manifest abatement of his wonderful forces.

Among statesmen and warriors the strong and healthy predominate, though there are exceptions. As already noted, Bacon was not robust, nor were the Duke of Luxemberg and the Prince of Orange, mentioned previously. The greater Prince of Orange, William the Silent, was of a very different type, as were Marlborough, Gustavus Adolphus, Cromwell, Frederick and our own model of physical manhood, Washington. Among statesmen we may compare with Bacon such men as Gladstone, Bismarck and Lincoln, all of them giants in physical powers.

It goes without saying that the superb will of Napoleon "had its roots in an abnormally firm vitality." His bodily machinery, of which he in some ways took fastidious care, furnished him with a supply of nervous energy at Napoleonic pressure which sufficed for a working day of from fifteen to eighteen hours. He said of himself that he "was conscious of no limit to the amount of work he could get through." It is interesting to note that his critics have made careful study of his physical condition as affecting the outcome of his last compaign. Most of them are of the opinion that there was a visible physical decline, one dating this from the cold of the Moscow campaign; others from his confinement at Elba, while one who knew him well attributed the lassitude which now and then came over him to the feeling of perplexity in the new conditions under which he worked. Whatever may have brought it about, the Napoleon of Waterloo "was no longer the Napoleon of Marengo or Austerlitz, and, though he was not broken down, his physical strength was certainly impaired."

In selecting the representatives of various kinds of brain work, the author has tried to be unbiased by his thesis, and for good-measure allowance to the common notion, has admitted a few names to the list, such as those of the Duke of Luxemberg, which would hardly nowadays find place among the immortals. Of those mentioned, some seventeen may be said to have been more or less delicate from childhood, though most of these were by no means sickly much of the time. Some eight or ten more, like Darwin and Spencer broke down after a healthy, vigorous youth and early manhood. At least fifty were robust and many of these remarkable for physical powers. The remainder were probably above the average in physical endurance, even if their physique and health was not so impressive.

Genius, superior mental power, or whatever we may choose to call that quality which lifts one man above his fellows in any line of work, does not prefer to have lodgment in inferior bodies, and when this so

happens, it finds itself sadly handicapped. Though the soul tides may at times rise very high in those of frail physical nature, the ebb is always lower and more prolonged than in those possessed of greater vitality. The handicap of weakness and ill health has been most recognized by greatness itself, and we have eloquent comment upon the value of health and strength from such men as Plato, Bacon, Locke, Montaigne, Addison, Wesley, Spencer, Molière, Franklin, Carlyle, Beecher and others.

The handiwork of an artist or executant musician is, in a way, a record of his physical condition, and for him to do consistently good work health must be equally constant. Even Michelangelo failed as a sculptor in his later years, though he flourished as an architect. The combination of brain and hand work is in itself conducive to better health than brain work alone, which may also help account for what, in our brief preceding list, would seem to indicate the superior health of such men.

The pursuit of religion, philosophy and science may be more spasmodic, but even here health and strength add greatly to the product, in both quality and quantity. Had the more vigorous men of the middle ages devoted their talents to spiritual affairs, the reformation might have come earlier or might not have been necessary. To-day the church recognizes that the adequate unfolding of the bodily forces is necessary to the full use of the mental powers with which one may be endowed. Asceticism has given place to temperance. Crusades for the sake of a sepulcher are succeeded by crusades against conditions which war upon physical sanity.

It is inspiring to know what has been accomplished under heavy handicap, but it is sad to contemplate what the same mental powers might have accomplished had the handicap never existed. There are quite enough other agencies for tempering and annealing the soul without preventable sickness and infirmity, and an untimely end rings down the curtain before the possibilities of the player are fairly exhibited.

One can not distinguish a fool from a philosopher by either his appearance, physique or vegetative capacity, but, given the finer mental endowment, he in whom that equipment is backed by superior physical balance and endurance is sure to prove the man of larger accomplishment in every sphere of endeavor.

# WOMEN TEACHERS AND EQUAL PAY

By Mrs. ELFRIEDA HOCHBAUM POPE

ITHACA, N. Y.

ARGUMENTS opposing the progress of women are apt to begin with a praise of "typical, sweet" femininity, continue with a retailing of the fixed and inherent failings of women, add instances of selfish action on the part of individual women, such as taking away a man's seat, obstructing a man's view, getting in front of him in a ticket or bank line (forgetting that women have been carefully educated to consider themselves as creatures of privilege), and end with visions of race-extermination.

Arguments opposing the equal remuneration of women with men, where the services rendered are of equal value, have not escaped contamination from this kind of logic, in witness whereof we can point to two articles published in the *Educational Review,* in the past year, entitled "The Monopolizing Woman Teacher," by C. W. Bardeen, and "Women and 'Equal Pay,'" by Arthur C. Perry, Jr.

It was in 1869, forty-four years ago, that J. S. Mill wrote:

> The general opinion of men is supposed to be, that the natural vocation of a woman is that of a wife and mother. I say, is supposed to be, because, judging from acts—from the whole of the present constitution of society—one might infer the direct contrary. They might be supposed to think that the alleged natural vocation of women was of all things the most repugnant to their nature; insomuch that if they are free to do anything else—if any other means of living, or occupation of their time and faculties, is open, which has any chance of appearing desirable to them—there will not be enough of them who will be willing to accept the condition said to be natural to them. If this is the real opinion of men in general, it would be well that it should be spoken out.

After nearly half a century's progress of civilization and thought, it remains for an educator to speak out this very sentiment in the following words, apropos of the granting of equal salaries to men and women in the schools of New York City:

> Suppose society were to embark upon a world-wide attempt thus to abrogate natural and economic law by legislative fiat. A severe temptation would be placed upon all women wilfully to disown their natural mission in the scheme of nature. With the material reward before them double that which the normal life would yield, they would become unwilling to renounce the larger for the smaller. There would follow a gradual but sure lowering of the wage standard set for both men and women until both sexes were on a basis of self-support only. Under this condition neither sex could be expected to undertake the support of a family and the family would disappear.

This strain immediately gives us our clue, for we have heard it often before, as when we laid claim to souls and to minds, and though the gods of nature and of economics are appealed to, we know that we are dealing with the ancient sex prejudice, conscious or unconscious, which the present day is gradually overcoming with the increasing realization of the sanctity of human personality irrespective of sex.

It was still longer ago that Wendell Phillips said, in 1851:

> When Infinite Wisdom established the rules of right and honesty, he saw to it that justice should be always the highest expediency.

What is the clear and natural justice of paying women teachers equally with men? Two persons are expending an equal amount of energy in rendering services of equal value. In exchange a return energy is given in the form of financial reward. There is no reason why the return energy should diminish in quantity, the moment the recipient is a woman, but retain its normal volume if the recipient happens to be a man. Is it not an ancient principle of justice that the laborer is worthy of his hire?

The immediate reply to this will be: It is just that a man receive more, because he has to support a family. And Mr. Perry, whose argument rests on the ethics of not violating the principle of the "market-value" of teachers, unmindful of the principles of the bargain counter, says:

> The fact that the great majority of men have families to support has led to an economic balance whereby men's wages expressed in terms of money are such as enable a man to support his family.

This is plainly an economic fallacy, since wages and salaries are not a result of a nice adjustment to personal and family needs. A man supports his family in accordance with his wages; he does not receive wages in accordance with his family. And does the man who has no family receive less and the woman who has a family receive more? Is it the custom to arrange salaries on a sliding scale in accordance with celibacy or marriage among men? Why is it that late marriages are so common? Is it not because the incomes earned are thought not to be sufficient for the support of a family? Does any one know of a scheme like the following? An instructor in a university receives a salary of $1,000 a year, and manages to be fairly comfortable on it. He marries, and the trustees grant him an additional $100. He has a child, and his income is increased again by $100, and again for every succeeding child. We leave it to the trustees to estimate the proper value of a child on the basis of a full professor's salary. Now the wife dies, and $100 are subtracted from his salary, and as his children become self-supporting the salary is reduced in proper measure, leaving him, when all his children have departed in the *status quo* with his original

salary, for as a single person he requires no more. No doubt such a sliding scale would be most acceptable to college instructors so long as it went up and would encourage early marriage. The only bitter pill would be to have the scale slide down. In the actual world, however, the bachelor does not receive less because he has no family and the married man does not receive more because he has. The woman teacher still generally receives even as high as fifty per cent. less than a man, whether she has a family to support or not.

But, it is replied, the single man expects to have a family in the future for which he must lay a financial foundation now. Is then the young woman not expected to have a family? Will her savings be less of a help to the future family because they are feminine? Or will they go farther for the same reason and do they therefore not need to be so great? Is not the family the ultimate loser by this principle of stinting women, since the family funds are derived from one source alone? After marriage, if both father and mother are capable of earning, is the family not the gainer if the earnings of the mother are at the same rate as those of the father? If the father dies, is the family not the gainer by having full support instead of two thirds or thereabout?

The highest expediency that attaches to natural justice is brought out by an economic principle that few will dispute. Women who are discriminated against in the matter of pay immediately become a cheap labor class, and cheap labor is bound to injure the cause of well-paid labor. This injustice bears within itself the germ of that economic vengeance that has wrought such harm in the profession of teaching, and has been so conducive a factor in driving men out of the ranks. This principle has been brought home to the laborers in industry, and in the ranks of labor the feeling is becoming wide-spread that men and women have a common cause, and all movements that make for economic improvement for women are apt to find there much greater support than in the so-called higher ranks of society. The world of trade could easily appreciate the principle also. If a woman set up a successful business with a margin of profit 25 per cent. or 50 per cent. less than that of her masculine competitors in the same business, would the men not immediately protest and combine to force her to sell at their terms or to wreck her trade?

It has been stated that where men and women teachers receive equal wages the men will vanish. This assertion, however, seems to rest on the implication that the wages are low, for when it has been suggested that women receive the high wages of men, opening the way for a natural competition irrespective of sex, the answer has frequently been that the natural result of this competition would be that the men would be chosen and the women would be left. Now certain qualities excellent in a teacher have been conceded to women. For instance:

**Taking it altogether the fine women who as a whole make up our teaching force exert a healthful influence over their boys and are successful disciplinarians. The woman is quite as apt as the man to establish that connection between her mind and the child's which is the foundation of instruction.**

Even a woman's knowledge is apt to be sufficient, at least for the high school. But it is possible that these virtues exist only at a low rate of wages and take wings at an equal high rate. It is one of the characteristics of arguments springing from the traditional view of women that quite opposite assertions are made to fit the same theory. Thus women are better than men and they haven't so pronounced a moral sense; they have no time for professions, and they waste time in frivolity; they are thrifty, and they are extravagant; they are physically weak, and do the physical work of the household; in the case of women teachers, they drive men out of the profession of teaching, and they can not compete with men; and again: they are not worth so much because they leave teaching to marry, and they are not worth so much because they do not marry. Perhaps it would be safest to adopt the high and equal rate of salaries even if it leaves man, as the superior teacher, victor in the field, since in education we are concerned with the best results obtainable. We sincerely trust and believe, however, that even at an equal high rate of pay it will be realized that men and women are needed in the schools as in the home. Woman is as much a factor in human life as man, and her interpretation of life and knowledge is just as necessary for a complete view. If there is no difference between the masculine and the feminine viewpoint surely there is no reason for discrimination. But the very possibility of a difference of conception is of immense potential value educationally, and forbids a lessening in value because of sex. Surely if we need the feeling for and interpretation of the "Arma virumque cano," the destructive ele- the feeling for and interpretation of the

> Prima Ceres unco glaebam dimovit aratro,
> Prima dedit fruges alimentaque mitia terris,
> Prime dedit leges: Cereiis sunt omnia munus.
> Illa canenda mihi est

of the constructive element of civilization by representation through fostering womankind, especially as arms are beginning to lose some of their prestige. But as long as we regard education as a thing to be provided, in large measure to be sure, but at as low an expense as possible, we shall encourage the cheap labor of women teachers and the proportion of men and women will not be normal. As soon as we realize that education is an investment whose returns are to be measured in quality and diversity of knowledge and of character, we shall be glad to invest capital in that enterprise, though for intangible and indirect returns, and we shall recognize that woman's share in the product is as important as man's.

As far as the theory goes, held by Mr. Perry, that a budget permitting the expenditure of only a certain fixed amount for teachers' salaries forces a reduction of the men's salaries because of the necessary averaging, it is a matter of fact that a budget can always be increased where the need is felt to be actual. Even the "practical administration difficulties" of a huge system like that of New York City should not prevent meeting actual needs. In smaller systems, the budget can always bear an increase when a man teacher is needed who will not come at the salary allotted to women. In women's colleges the principle of exclusive femininity is inevitably disregarded through the crying need of some masculinity, possible naturally only on the teaching staff. A certain proportion of men is felt to be absolutely necessary either for the sanity of the educational process or for the protection of the masculine teachers themselves from the danger of feminization. When that proportion is threatened the budget does not stand in the way. And thus it is possible for a new-fledged doctor of philosophy, untried and without teaching experience, simply because he is a man, to obtain a salary 25 to 50 per cent. higher than that of a woman professor who may have greater knowledge, greater experience and every requisite for a successful teacher. Is it a wonder under such conditions that we do not find women stimulated to do more productive work? It is quite possible, too, that the youth has no obligations whatever, and that the woman has financial and family obligations. It is possible that the case of obligations may be *vice versa*. It is certainly wrong for us to assume that the man has always the financial burdens to bear, the woman never. Can we, who have taught in college and high school, not name numerous cases of that kind? Do we not also know of men teaching in the high schools who were merely taking advantage of the relatively good salaries they could obtain as teachers until they could get a foothold in another profession, thereupon to leave the teacher's calling forever? And have we not seen in the same schools women teaching at lower salaries, some of whom were supporting relatives, sending brother or sister to college, and some even husbands?

As far as the theory of the market value of the teacher goes, we need only point to Germany to be covered with shame for our mercenary attitude towards education. In that land swarming with Ph.D.'s, despite the enormous supply, the teacher, masculine, to be sure, receives a very fair salary and generous pension provision, without regard to a market value determined by the laws of supply and demand.

The same principle and view of life that reduces the pay of the woman teacher reduces the pay of women in whatever field. It forces girls in factories and department stores into lives of shame, and gives the washerwoman who supports a family (and who ever hears of a washerwoman who has not a family and sometimes a husband, too, to

support?) for labor that is by no means unskilled $1.25 a day, while the unmarried Italian who digs ditches gets $1.75 or $2.00.

There are other causes, to be sure, besides sex discrimination, which have encouraged unequal wages. Foremost among these is that women have not realized their own worth, have not demanded equal wages, have not been able to do so, in fact, through lack of organization. Moreover, in the past, women were crowded into a very few callings, among which teaching was a very prominent one, and thus they competed with each other. In the past, too, when women left the home to work, it was because they were forced to. Any addition, however meager, to the family income was welcomed. In the higher walks of life, again, women were content to earn the luxuries, depending on their families for the home and necessities. The parents, meanwhile, took pride in the fact that their daughters did not "have to" work. The effect on the worker, on the profession and on the family was bad. You got cheap labor, poor and half-hearted labor, and the family was out something, too. With modern times has come the realization that labor and self-support are necessary for the dignity, the character and the development of women, and that the welfare of society and of the family demands that she become a contributor of wealth rather than a mere consumer. But we shall not have the best efforts from women in professions until professional rewards are open to them. That increase of salary, with advance in position, based on merit alone is a necessary stimulus no one can deny. It will be well when all women realize the harm that is done, not only to their sisters, but to their profession, when they permit themselves to be stamped as cheap labor.

And as for the man, we fear that it is not chivalry that fails to recognize the equal value of woman's labor with his own. We fear that it is not chivalry that frowns upon the married woman teacher. And so we hope that he will be moved to a more generous spirit when he realizes that woman's loss is his own. The modern marriage is a halving of resources, whereas the colonial family was a doubling of resources. What the wife formerly actually produced by the labor of her hands in the way of food, clothing and household supplies, in a personal field of industry, quite free from competition either with her own sex or with the other, she must now produce in the form of the wherewithal to buy the food, clothing and household supplies. Her field has become wider, she must compete with others, but her capabilities have also grown wider, and must increasingly grow as she, with her husband, progresses farther and farther from that rude and simple life that was enclosed by four walls and called forth only a few of the manifold potential powers of hand and mind. Men must come to an insight of the economic waste of an unproductive life for their women, or of production without fair returns. But perhaps they will also begin

to realize forms of waste that are not so material. When women, through motherhood, have that insight into the growing mind that no one else can possess, we prefer to have them withdraw from the profession of teaching. Is there no sense of a tremendous pedagogical loss? Because women alone can be mothers is that a reason that they should be nothing else? Shall their souls and their minds be refused their proper occupations even after motherhood is past, and shall they be condemned to atrophy because of a great though not exclusive function? Is there no insight into this spiritual waste? Does not society suffer from all these forms of waste? When we demand that a woman sacrifice her talents and ambitions, in other words, her natural powers, in order to become a wife and mother, we must not close our eyes to the fact that it is a sacrifice, and that sacrifice means waste. Our marriages rest upon a wasteful basis, and must become increasingly wasteful as civilization takes away more and more woman's former productivity in the home, unless she is granted a free field for her energies outside of the home. The young woman teacher must look forward, then, to contributing her share to the establishment of the home by her earning powers before she is married and afterwards when she can. The more she earns, the better. With this earnest view of the necessity of contributing to the family support, her profession will become something more than a means of occupying durance vile. It follows as the night the day that early marriage will be encouraged where two are contributing, and when marriage does not mean sacrifice and dependence on one side, and sacrifice and a heavy burden on the other side. Men, while necessarily bearing the financial burden alone for some of the time of married life will yet not be sacrificing more of their individual energy to the family than the mother who is giving of her life substance. For the woman a life of development and service will be added to motherhood, as a life of development and service are added to the fatherhood of the man. For we conceive of fatherhood as something more and nobler than the occupying of all one's time and energies with earning money for the children. Will there not be more time for fatherhood when the pressure of financial responsibility is lessened? And who knows what rich rewards of womanly forces future society will reap from allowing women to develop according to the divine promptings from within rather than by rule of man. For the full honors and rewards of effort, whether in the household or in scientific academies, have never yet been granted to women. They have never yet been permitted to drink freely of the cup of life. Let the men who openly or covertly regard women as their inferiors consider this, and for the sake of the future give her an equal chance. It was Schopenhauer who said, in quite a different connection, we may be sure, "First they bind our arms, and then they sneer at us because we are

impotent." And it was Wilhelm von Humboldt who wrote of "the absolute and essential importance of human development in its richest diversity." If women are to develop humanly, they must not be arbitrarily cut off from the inspirations and the rewards that stimulate the growth of human mind and character.

A discussion of this general nature seemed necessary, because it was felt that prejudice against remunerating women teachers equally with men was mere prejudice based on a failure to grasp the wide bearing of the forces at work in the natural and historic evolution of women. We have still to consider the fact that there will always be some women in the profession of teaching who no longer look forward to marriage, though the *terminus ad quem* of this hope is nowadays very problematical, and who have no dependents whatever. This will be true, even after women have become large factors in all the professions, in most of which they already are represented, and after they have invented some new ones. But their number will not be very much greater than that of the single men in like circumstances unless women preponderate immeasurably in the population. If there were an injustice in giving them the full return for their labor, it would yet be less than the sum total of injustice of the old system. Moreover, dare we not hope, with the special penchant of women for charity and philanthropy, with the noble roll of "old maids" who are milestones in the progress of civilization, Frances Willard, Florence Nightingale, Clara Barton, Jane Addams, that the surplus energy earned will go for the improvement of society? Society needs the development of all its latent energies for its own purification and advance. Who dares, unless he was present when the foundations of the earth were laid, brand woman's energies as inferior because proceeding from a woman, and say to her, "Hitherto shalt thou come, but no further"?

# THE BUSINESS MAN AND THE HIGH-SCHOOL GRADUATE

By JAMES P. MUNROE

BOSTON, MASS.

NOT so very long ago the merchant, the manufacturer, the teacher, the young man, and the public in general were under the spell of the boys' magazine, wherein the first prize—the prize of partnership in the business and marriage with the "old man's" daughter—is awarded to the boy who keeps his hands clean, brushes his shoes, picks up stray pins on the office floor and carefully saves the twine from his employer's parcels. To do these things is indispensable; but besides this, the aspirant for partnership (and the daughter) must also—according to the story-books—write a perfect hand, never make a mistake in addition, never forget a message, never have a deceased grandmother on the afternoon of the ball-game, never think of aught except mastering every detail of the business, never be anything, in short, but the kind of prig that real, red-blooded boys are not.

The so-called Manchester school of political economy was built around a supposed economic man wholly unlike any human being ever born. Consequently there were promulgated for nearly a century a host of solemn fallacies which have given, and are still giving, endless trouble to civilized society. In much the same way the supposed demands of business upon boys have crystallized around these story-book heroes and have led the business man, the boy and the boy's teacher into all sorts of difficulties, misunderstandings and wild-goose-chases after educational impossibilities.

It may be that the story-book boy and the story-book employer—and even the daughter—did exist at some period anterior to the middle of the nineteenth century; but since that time all three have been as extinct as the dodo. Yet much of the thinking and much of the talk about the demands of business are based, even now, upon these ancient and mendacious yarns.

To reach any sound conclusions, to-day, however, one must rid himself of the obsession of these romantic fallacies and must face the actual facts. The clean-hands, blacked-shoes fallacy has ruined thousands of boys who, if they had pitched in and got their hands dirty, would have turned out first-rate mechanics and mill-men, instead of sixth-rate clerks. The pin-picking and twine-saving fairy-tales have started many a boy on the downward path of petty, two-cent economies instead of on the upward way of large-minded, far-seeing business policies. While as for the other things demanded by the story-books—they are about as obsolete as sand boxes and quill pens.

Who seriously cares about long-hand writing, when actual busi-

ness to-day is done by the aid of shorthand and the typewriter? What is the use of drilling a boy who has cost the community at least $4,000 into becoming a fairly accurate adding machine when one can buy an absolutely accurate metal one for a hundred dollars? Why lay so much stress upon errand running when the telephone is a far more efficient messenger? Why talk about learning all the ramifications of an industry, when the main hope of business success is in being a first-rate specialist? Why even specify that the boy shall know how to wield a broom, when the incorporated cleaning company will sweep the offices, and sweep them well, for far less money than the wages of the veriest greenhorn?

Should the present agitation over vocational education come to nothing—which is almost inconceivable—it will have been worth while if it forces teachers, boys and, eventually, employers to ask themselves straight questions and to face actual conditions. What does modern business really require of the average boy? How fully can the boy meet—or can he be trained to meet—those requirements? And, finally, what can the school do and how far can it go in bringing the boy into line with the reasonable demands of a rational, up-to-date mercantile or manufacturing concern?

Just now everybody is in a turmoil over all three of these problems; for all of us—business men, boys and schools—are in a transition state. Business itself is in the travail of readjustment—as witness the attempted regulation of it by the Congress and the states; and as witness, also, the vogue of anything that labels itself scientific management. The young man—still reading the old story-books about business—is finding out that those tales and the real conditions are not even fourth cousins to one another. While the schools, tired of putting boys through the treadmill work demanded by formal college entrance examinations, and looking for some better incentive to hold before the pupil, are turning (generally with more eagerness than knowledge) towards preparation for business as something at once tangible to them and interesting to the youth.

It is a tremendous point gained, however, that all three of them—business man, boy and pedagogue—are working at the same problem, each from his own angle of vision, but all seriously; the business man being desperately in earnest as he finds that profits are dependent upon securing really trained men; the boy being more and more driven, by modern competition, to weigh the problems of his after-school vocation; and the schools, as the educational tax gets heavier and heavier, feeling ever more keenly the need of showing tangible returns for the millions given every year to education.

No business man can presume to say, however, that those millions are thrown away so long as he is every day wasting much good material (both human and inanimate) through haphazard, antiquated and

unscientific ways. Since he is manfully buckling down, however, to the problems of real conservation in manufacturing, transporting and selling goods, so must the teacher, also, get down to actualities. For in all industries the chief element to be conserved is the human element; and the teacher is paid by the state to understand, guide and give a right start to his quota of those boys and girls who are to be the producers, distributors and consumers of the coming time. For years and years everybody has been saying that the real work of the schools is to produce good citizens; but no one—broadly speaking—can be a good citizen unless he is an able producer and an intelligent consumer. Education that does not have these ends in view results in dreamers, parasites and social anarchists. Education that does recognize these aims is in line to produce self-reliance, self-respect and social responsibility—the three main bases of sound citizenship.

However high the ideals of all teachers should be, however strongly they should insist upon breadth, culture and "uplift" for their pupils, every one of those noble things of education should be soundly bottomed upon the no less noble demands of self-respecting, intelligent, purposeful winning of the daily bread. What higher and finer goal for all school life than the founding of a family and the rearing and training of the next generation? Yet how absolutely bound up with that true ideal of a civilized state is the ability to earn a living, in ways congenial to the earner and in such an amount that ease of mind, comfort of body and education for the brain and soul shall follow for the worker himself and for those depending on him?

Using the word "business" to cover all the fields of human activity along material lines—the fields of production, distribution and consumption—every boy and girl in every school is going to find his or her chief interests and his or her chief medium for development in the business world. Therefore, every teacher should understand—at least in a broad way—what business is, what it demands, and how those demands are to be met—so far as they can be met—by the school.

Obviously, however, the most zealous of teachers could not acquaint himself intimately with more than one general line of business activity; and it is a serious question whether or not, if he had so trained himself, he wouldn't then be doing the teaching profession a service by leaving it. The teacher must never forsake the teaching point of view—the view that his duty is not to train the boy for business, but to use business as a powerful instrument in training the boy. To do this, however, the teacher must understand not only boys in general, but also business in general. And, however great may be the differences between manufacturing and merchandizing, between banking and baking, there are certain fundamentals characteristic of substantially every branch of that production, distribution and consumption of commodities—noting that consumption, and therefore household management, is put

on a par with production and distribution—which is gathered under the one comprehensive term: modern business.

The most striking characteristic of modern business is the rapidity with which it is moving from a competitive to a cooperative basis. This is resulting, on one hand, in the "trusts" and other combinations, which furnish so much good copy for the newspaper and the congressman; on another hand, in the public service corporations, wherein quasi-public needs are supplied by quasi-private bodies; on another hand, in that genuine cooperative production and distribution with which we are less familiar than are the Europeans; and, finally, in that public ownership, pure and simple, which the modern politicians are falling over one another in their haste to promise to the people in exchange for the people's votes.

In whatever form it may appear, however, cooperation results in two things: bigness and complexity. When two men form a partnership the profits may be out of all proportion to the business paraphernalia. But when oil producers get together, and then (at the behest of Congress) unmix themselves again; when the subways, elevated roads and surface lines knit themselves into a single great transportation cobweb; when the workingmen of a whole county decide to buy their flour at a single purchase; and when forty cities and towns combine to supply themselves with water; then there result not only a bigness that has taught us to talk in billions as easily as our fathers talked in hundreds of dollars, but also a complexity which staggers us poor outsiders and, there is reason to believe, staggers the insiders as well.

The third feature of modern business, growing naturally out of the characteristics of bigness and complexity, is that profits to-day are made by the geometrical progression of innumerable small gains instead of through the adding together of a few large gains. Selling a few hundred things at a good profit in a country store in New York state brought in to Mr. Woolworth's employer a few thousand dollars a year. Selling millions of things for not exceeding ten cents each has enabled Mr. Woolworth himself to capitalize at $75,000,000, and to erect the highest building in the world. The mining fortunes of yesterday were made by working the richest veins and pockets, leaving the rest to waste. The mining fortunes of to-morrow will be made from the dump-heaps of abandoned plants. The day of the telescope in business, the day of seeking new worlds in order rudely to exploit their natural resources, has gone by; and the day of the microscope in business, of getting infinitesimal profits infinitely multiplied, has come. Thus far we have been a world of wasters; henceforth we are to be a world of savers, and are thus to outwit Malthus and to make the world's resources not less, but greater, by every added baby born.

A marked characteristic of modern business, consequently, is (in merchandizing) frequent "turn-overs," and (in manufacturing) the

utilization of what used to be called waste. The stream of trade flows so fast through a modern department store that the one cent profit here and the two cents profit there aggregate in the course of the year a huge amount of money. According to a recent article in the "World's Work," the beef barons actually lose on sirloin steaks and choice cuts of pork; where their profits are made is in converting every scrap of the animal's carcase into something that can be sold.

To keep the stream of business flowing through a great store, and to make it profitable to save every hair of every beast in the Chicago stockyards, however, there must be highly-developed organization, highly complicated machinery, and just as little as possible of that most expensive form of power, the human hand. Human hands are still wanted, and in proportionately greater numbers than ever before in history; but merely as servants to machines that multiply hundreds and thousands of times the initial force given by those hands. It is nonsense, however, to talk of this as slavery to machinery. On the contrary, it is mastery of the forces of nature, an ever-increasing mastery, which is—so to speak—kicking the brute laborer, the pick and shovel man, up into the ranks of the machine-user, and is kicking the machine-user up into the ranks of the organizer, those ranks where brains are every day setting hundreds and thousands at new work, and every day bringing what used to be luxuries down to the horizon of the commonest man. The cost of living is high, not because of the scandalous luxury of the rich, but because of the commendable luxury of the poor. It is true that the desire for the good things of life is growing somewhat faster than the devices and economies of modern industry can bring those good things within reach; but this is simply a question of gradual adjustment. And the fact that more men are every day wanting and demanding more things is one of the surest guarantees of a continued and genuine prosperity.

An inseparable accompaniment of machinery, however, is speed. Therefore the next notable characteristic of modern business is whirlwind pace. Thirty years ago, even New York, Paris and London were horse-car towns, with clerks nodding over pigskin ledgers, errand boys playing marbles in the roadway, with no telephone, no rapid transit in the modern sense, with scarcely any devices for making speed or saving time. To-day, even London, the archetype of conservatism, is a whirlpool of motor-buses, speeding men and clamoring advertisements.

Consequently, not merely what the business man, but what modern business itself, demands of the high-school graduate is rational and orderly speed. In the high school, in the schools below, in that larger school, the community, and above all, in the boy's home, he must have been trained to "go the pace," not of dissipation, but of modern industry.

Since, however, no one can get speed, without a breakdown, out of a weak or badly-built engine, so one can not get efficiency from a half-

sick or ill-developed youth. Consequently, now as never before, the business world must have boys who are sound in body and in nerves and who know the value of good health, clean living, exercise, right eating and fresh air. As already intimated, the average boy of eighteen has cost the community at least $4,000 to "raise";—most high-school boys have cost a good deal more. Furthermore, to train that $4,000 boy to the point where he is a real asset in the business, costs that enterprise a considerable additional amount. Therefore the community can not afford, the business into which the boy goes can not afford, to have him break down, because of a weak body, poor nerves, or dissipation, just when he is beginning to bring in fair returns upon his capital cost. The first thing, then, that modern business demands in its apprentices is sound bodies, steady nerves and a good working knowledge of hygiene. These things are worth far more than a knowledge of double-entry bookkeeping; and the school, in cooperation with the parents and the community, must provide this kind of teaching.

The next essential for speed is quickness of mind, nimbleness of body and good coordination among all the senses. One doesn't acquire these, however, by stewing all day in an uncomfortable desk over a lot of books. One gets them by using all his muscles and all his senses, in a wide variety of exercises, mental, physical and manual, directed in educative ways and by rational progression, towards well-defined ends —not occult ends, seen only by the inner consciousness of the teacher, but tangible ends visible to the boy himself.

The third essential of speed is team-play. Every schoolroom should be an organism as well knit, as thoroughly balanced, as purposeful as a 'Varsity football team; for that is the kind of coordination towards which every mercantile and manufacturing enterprise is rapidly, and with full understanding of its value, tending. The teacher who still uses competition instead of cooperation as a main spur towards speed, is woefully behind the times, and loses that most valuable aid in education—working together for a common result.

Effective team-play, however, is founded upon promptness, ready obedience, willingness to subordinate one's self to the general good, enthusiasm, and that comprehensive quality called loyalty. All these are at the very root of every successful enterprise; and what modern business asks most eagerly is that the boys who come into it shall obey orders intelligently and promptly; shall see how much, instead of how little, they can accomplish to further the interests of the concern; and, in whatever they do, shall show the essential virtues of team-play: enthusiasm, self-subordination and unflagging loyalty.

But a man can not be enthusiastic and effective if he lives in a mere groove. Therefore, while the youth who is to succeed in the complexities of modern industry must be a specialist, he must be a broad one. A man may move fast in a treadmill, but he gets nowhere. On the

other hand, a motorist, though tied to a roadway, makes his twenty-five miles an hour because he sticks to that well-surfaced track instead of trying to wander through bushes, potato-fields and gravel banks. He doesn't leave the road, but he sees and knows the whole surrounding territory. Consequently a fourth essential of speed is thoroughness in one line with an outlook into many lines, with an intelligent interest in many things, and with a broad attitude towards all human interests.

A fifth essential of speed is the cutting of red tape. Circumlocution, that curse of the law, is being rapidly driven out of business, because a merchant or manufacturer can not afford to waste time and lose headway in doubling and twisting. If there is a short way of doing a thing—be it in business or in school—do it; and save time, money and nervous energy.

Therefore in demanding of the high school graduate rational and orderly speed, modern business asks the teachers of those young men and women:

1. That they do everything possible to send into business life sound animals who appreciate the value of good health and who know how to conserve it;

2. That they give those pupils such studies and exercises and in such a way as to result in activity of mind, thorough coordination between mind and body, well-trained senses and an eagerness to work and to learn;

3. That all the school work be so carried on as to foster a spirit of team-play, a sense of the value and power of working together for the common weal;

4. That to this end the teacher subordinate the memorizing of facts to the inculcating of promptness, obedience and loyalty;

5. That the studies which make for breadth of view and variety of interest be emphasized, and those which make for mere information, technic and drill, be minimized;

6. That, to accomplish this, subjects like arithmetic, bookkeeping, grammar, rhetoric, etc., be cut down to their lowest terms and fewest principles, throwing out all processes and exercises which are obsolete, little-used or cumbersome, putting in all the short-cuts and labor-saving devices which are of general application; and that those subjects, such as history, economics, political and economic geography, etc., which make for breadth of view; those exercises, such as rightly conceived manual training, ordered games, freehand drawing, etc., which make for quickness and control of the body; and those general school relationships which promote team-play, loyalty, the spirit of working together for a tangible and desirable end, be fostered, amplified, and in every way, encouraged.

Above all, the community high school should be the medium for leading the boy and girl from the irresponsibility of children into the

responsibility of men and women. With that end in view, the school days and weeks should be on a business basis, with long hours (diversified, of course, with a proper alternation of mental and physical activity), strict accountability on the part of the pupils, and an organization based, as nearly as possible, upon the best business and factory models. So long as youth of seventeen and eighteen do not take their high-school work seriously, they will not take business seriously. And it is this lack of seriousness, this failure to realize that success in business can come only from strict attention to business, which lies at the root of most, if not all, of the complaints made by business men against the products of American schools. Those employers find many, if not most, of the boys and girls who come for employment, unfitted for and, if I may use the word, unfittable into, the complex demands of modern business life. Remembering the story-books, they think it is because these aspirants can not write and cipher and spell. But they are fast finding out that the causes of the trouble, in most instances, are weak bodies, or untrained senses, or sluggish minds, or lack of purpose, or general immaturity, or ignorance of how to work with others, or an all-round irresponsibility, or a combination of from two to seven of these common human defects. Secondary schools can not, of course, make silk purses out of sows' ears; but they can make it their chief business to deliver to the business world boys and girls whose bodies, senses and minds have had so much organized training as heaven has permitted them to receive; who have passed out of the state of "kids" into that of men and women; who have a conception of and experience in co-operation and team-play; who know what loyalty means; and who have taken school work so seriously that they are prepared to look upon the earning of one's daily bread as something other than a listless game.

Modern business demands these things. Experience has shown that a rightly ordered secondary school system can produce them. That all schools do not is the fault partly of the teachers, partly of the employers, partly of the community in general, mainly of the parents. The fathers and mothers, and the rest of the community, must be educated to give moral and financial support to this effective type of education. But the only persons who can educate them are the schoolmasters; and they must do it in a roundabout way by gradually introducing this rational, real education into the higher and lower schools. The results will be so immediate, and in many cases so startling, as to make even the overworked business man take notice. And when he begins to realize that the school is really trying to meet his needs; when he begins to see that the millions poured into the public schools are producing efficient young men and young women, he will cease growling over his school taxes, and will turn some of the fortunes that he now gives or bequeaths to colleges into the far too lean treasuries of the higher and lower schools.

# VULGAR SPECIES AND THERAPEUTIC SUPERSTITIONS[1]

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THE search for the cause of things and events exists since the appearance of man on the face of the earth. The inability to explain things reasonably and convincingly induced the thinkers of ancient times to use their imaginative faculties. The ancient explainers of natural phenomena were the poets.

> The restless mind of man ever seeking a reason to account for the marvels presented to his senses adopts one theory after another, and the rejected explanations encumber the memory of nations as myths, the significance of which has been forgotten.[1]

The continual strife with the elements, the dreadful toils and dangers of man's life, the inclemency of nature—were all attributed to a perverse divinity or demon, who delighted to inflict pain and misery upon brief-lived mortals. Such a divinity needed worship and sacrifice to propitiate him. Humanity began to fear the devil before they imagined the god. The "earthworms" created the gods of goodness to protect themselves against the spirit of evil which they had incarnated.

With fear began superstition, which is based upon fear and ignorance. The desire to know the mysterious future has given rise to a great deal of the world's store of credulity in the supernatural. The ancient philosopher who desired to divine the future by means of geometrical figures, the pretty maiden who counts the petals of the daisy or dandelion to learn whether her lover will be constant, and the business man who allows the clairvoyant to pass on the lines of his hand—are the ordinary examples in life of the vain endeavor to raise the curtain that hides what is to be. Living beings fear death—a rational fear. In order to prolong life, the body is to be kept healthy, illnesses are to be avoided and, if disease does afflict an individual, the sickness is to be cured. This is all rational. But illnesses are almost inevitable in man's life, and diseases are not always cured or curable. Instead of combating disease logically, men of all classes drew upon their imagination and hashed various absurd means and methods of treating their ailments.

Coeval with the birth of superstition was the birth of magic. The charlatan who could unscrupulously play upon the feelings of his ignorant audience had quite a mighty following in every locality where

[1] Baring-Gould, "Curious Myths of the Middle Ages," p. 151.

human beings suffered and hoped. The establishment of the Roman Church in England did not cause the old Anglo-Saxons to abandon their ancient rites and ceremonies. The inhabitants still clung to the mysterious lore of the Druids, and were only able to attach themselves fully to the new belief by retaining quite a number of the heathen superstitions. Long after the coming of the Catholic missionaries to the British Isles, there throve in merrie England hundreds of magicians who were feared even more than the holy fathers. The ignorant person ever loves to compromise. He is never certain which god is the true god, and in order not to take chances, he sacrifices to more than one divinity, lest he be left in the lurch. Palmists, fortune tellers, necromancers, magicians, clairvoyants are always secure of a very comfortable livelihood, if they do but settle in those centers where ignorance abounds. For, indeed, they seem all omnipotent to the credulous mind. They can predict the future; they can prescribe for the patient when the learned physician has given up hope; they can sell love-philters; they can cast evil spells upon our enemies; they can give us an amulet which we can wear and be forever protected against fearful maladies; they can grant good luck, and tell us how to avoid dangers and pitfalls.

Above all, let us repeat, they can give us an amulet, or charm, to wear which will make us fearless of disease.

The selling of amulets by magicians is a very lucrative business even in the present day. Sometimes it is not the necromancer, but the church, which sells charms to its adherents. The word *amulet* has quite a variety of derivations from the Roman and Arabian tongues. Amulets were so called by the Latins because of their supposed efficacy in allaying evil; "*amuletum quod malum amolitur.*" Some think that the word is derived from the Latin *amula,* which is a small vessel of lustral water carried about by the Romans. In the Arabian language, *hamalet* means that which is suspended.[2] Certain charms are supposed to be valid against all evils or ailments, others are efficacious only in certain specific instances.

People are afraid more often of an imaginary, possible misfortune than they are of the present state of infelicity. Joseph Addison says:

> As if the natural calamities of life were not sufficient for it, we turn the most indifferent circumstances into misfortunes, and suffer as much from trifling accidents as from real evils. I have known the shooting of a star spoil a night's rest; and have seen a man in love grow pale, and lose his appetite, upon the plucking of a merry-thought. A screech-owl at midnight has alarmed a family more than a band of robbers; nay, the voice of a cricket hath struck more terror than the roaring of a lion. There is nothing so inconsiderable which may not appear dreadful to an imagination that is filled with omens and prognostics. A rusty nail or a crooked pin shoot up into prodigies.

[2] William Jones, "Credulities Past and Present," London, 1898.

I shall mention several curious charms or amulets that were prevalent in the various countries of the orient and occident. Among the Chinese, iron nails which have been used in sealing up a coffin are considered quite efficacious in keeping away evil influences. They are carried in the pocket or are braided into the queue. Sometimes such a nail is beat out into a long rod or wire and is incased in silver. A large ring is then made of it to be worn on the ankles or wrist of a boy till he is sixteen years old. Such a ring is often prepared for the use of a boy if he is an only son. Daughters wear such wristlets or anklets only a few years, or for even a shorter time.[3]

Galen mentions an amulet belonging to an Egyptian king, who is said to have lived 630 B.C. It was composed of a green jasper cut in the form of a dragon, and surrounded with rays. This was applied to strengthen the stomach and organs of digestion.

The Hebrews have quite a variety of amulets or charms, each of which has a specific virtue. In the middle ages, the quack necromancers did a thriving business among the Jews that had settled in Spain. Maimonides, the great physician, wrote vigorously against them.

> Believe not in the magician or the necromancer; they do but blaspheme the name of God.[4]

Still many of the old superstitions have remained with the Jews. When a gentile physician goes into the lying-in room of the Hebrew woman he will notice placards on all the four walls, written in the ancient biblical tongue. These papers invoke the aid of the great angels for protection against the evil spirits that may attack either the newborn infant or the mother.

A mystic charm worn even at the present day bears the inscription *Abracadabra.* The word *abra* which is twice repeated in this amulet is derived from the initial letters of four Hebrew words: *Ab, Ben, Ruach Acodesch,* which signify Father, Son and Holy Ghost. During the times of the Crusades and for a long period afterwards, the very rich or the very noble carried about them, or kept hidden in a holy shrine, amulets made from a piece of wood from the true cross. As somebody has well said,

> A grove of a hundred oaks would not have furnished all the wood sold in little morsels as remnants of the true cross; and the tears of Mary, if collected together, would have filled a very large cistern.[5]

Sometimes the charms worn were not so harmless, and had no sentimentality or mystery to grant them fascinating potence. Very frequently, horrifying things and repulsive substances were carried about to ward off illness. In Egypt[6] the finger of a Christian or Jew, cut off

[3] Doolittle, "Social Life of the Chinese," II., 309.
[4] Maimonides, "More Nebbuchim."
[5] C. Mackay, "Memories of Extraordinary Popular Delusions," 1850.
[6] Lane, "Modern Egyptians."

a corpse and dried, is suspended from the neck and is reputed to have the powers of an amulet. In Flanders, a sick person imprisons a spider between two walnut shells and wears it around his neck.[7]

There were also *specific* amulets in circulation. For every ailment or unhappiness there was obtainable in the market of the necromancers, a charm which was supposed to have a certain beneficial influence for the affliction. Guttierez, a Spanish physician, who wrote a book on "Fascination" in the year 1653, states that children of that country wore amulets against the evil eye. In case a person who had the evil eye should gaze upon a child wearing this stone-charm, the vicious influence of the gaze will be attracted by the stone which will then crack.[8] For epilepsy there was in circulation a charm which had this inscription:

Jasper brings myrrh, and Melchior incense brings,
And gold Balthazar to the King of Kings;
Whoso the names of these three monarchs bears,
Is safe, through grace, of epilepsy's fears.

For convulsions, as another example, they used to wear a necklace of beads from the root of the peony. Pliny tells that for headache a remedy to be tried is the halter by which somebody has been recently hanged; this should be worn around the neck of the patient. In 1726, Philip, Earl of Chesterfield, wrote in great praise of the Goa Stone:

The Goa Stone is an admirable preparation of various ingredients; it is made by a Jesuit at Goa; it hath the same effects with the Lady Kent's powder, but is much stronger; it is a sudorificke, and expels all poisons and humors in the blood; it is admirable in all feavours and agues; it drives out measles and small-pox.

There was a belief current in the middle ages that the cries of animals had each a significance. A very plausible arrangement of the cries was made by a certain anonymous genius. One must, however, be a scholar of Latin in order to understand what the animals were saying. Arranging the conversation of the beasts in the form of a dialogue, we have the following curious effect:

Cock: Christus natus est.
Duck: Quando, quando?
Raven: In hac nocte.
Cow: Ubi, ubi?
Lamb: Bethelem.

"Incredulity," said Ashmole, "is given the world as a punishment." It is no wonder then that human beings in order to avoid this penalty, believed all that was told them, and relied upon others to grant them the same courtesy; and then acting upon this privilege or license, helped to burden the lore of the world with tales of absurdity and incongruity.

[7] Chambers, "Book of Days," I., 372.
[8] T. H. Knowlson, "The Origin of Popular Superstitions."

> No natural exhalation in the sky,
> No scope of Nature, no distempered day,
> No common wind, no customed event,
> But they will pluck away his natural cause,
> And call them meteors, prodigies and signs,
> Abortions, presages and tongues of heaven.

I shall endeavor to give a list of various specifics that were recommended long ago and are still in vogue wherever ignorance abounds. I am indebted to various authors of books on magic and superstition for various references to ancient customs. The excellent "Collectanea" of Vincent MacLean has saved me a great deal of trouble and labor in the looking up of old customs and credulities.

For every evil invented by the devil, God has created a remedy. The cure was not always known, because the ingredients of the medicine were very numerous and varied. In order to obtain the remedy in its full efficiency, the portions that made up the various concoctions were to be in exact proportion, otherwise the medicament would prove futile. The numberless combinations possible were to be tried out, and those that proved beneficial were treasured. Certain localities did a roaring trade in the sale of the specific for which it was noted. In the modern times the nostrum and patent-medicine has replaced these Meccas of healing, and the descendants of the ancient sufferers and believers are now helping to fill the coffers of the quacks.

As a method of curing himself, man has attempted to rid himself of his disease by transferring it to the stranger or the foe. In Germany a plaister from a sore may be left at a cross-way to transfer the disease to a passer-by. "I am told on medical authority," writes a certain author,[9] "that the bunches of flowers which children offer to travelers in southern Europe are sometimes intended for the ungracious purpose of sending some disease away from their houses." The contagiousness of ailments were known in olden times, and this desire to cure themselves by transferring the malady to somebody else was often the cause for the outbreak of violent epidemics in the whole neighborhood. Sometimes, instead of passing off the sickness to a human being, they attempted to give it to some animals, and thus rid themselves of the affection. A child that was suffering from scarlet fever was treated by taking some of the hair of the patient and giving it, concealed in the food, to an ass, which was to contract the fever and thus cure the patient. A similar procedure was in vogue for the treatment of measles; the hair from the nape of the neck of the child was given to a dog. A patient that had rickets was passed over the back and under the belly of a donkey nine times, uttering no word but the successive numbers. The good-women advised anybody that had convulsions or fits to try this simple remedy:

[9] Tylor, "Primitive Culture," II., 137.

Every morning while fasting, the subject is to chew a piece of grass and give it to a jay to eat; when the bird dies, the cure ensues.

In northern Europe the fays, or fairies, were vested with the dreaded power of inflicting disease. Fairies were supposed to be evil spirits which might be propitiated by giving them a gracious appelation.

> By giving diseases and other evils a good name when speaking of them, the danger of bringing them upon oneself by his words, is turned away. For this reason, fairies were called *Eumenides* by the ancients, and "good people" by the Celts.[10]

Morier[11] mentions a general superstition which he found also in Persia that to relieve disease or accident the patient has only to deposit a rag on a certain bush, and from the same spot take another which has been previously left from the same motives by a former sufferer.

There are certain minor ailments which even in the present day, the experienced grandmother thinks herself quite as capable of administering to as the most respected doctor. In olden times children suffering from skin eruptions or from general ill-health were taken to certain ancient dames, who, by means of incantations and exorcism, were able to drive out the devil from the body of the child.

> In the small villages of Russia when a child is suffering from a cutaneous disease of the face, it is taken to an "old woman" who mumbles some words and spits several times into the mouth of the child.[12]

Incantations were one of the strongest weapons of defense against all the maladies. A person afflicted with ring worms, for example, takes a little ashes between the forefinger and thumb on three successive mornings, and, before having taken any food, holds the ashes to the part affected and says:

> Ringworm, ringworm red,
> Never may'st thou either spread or speed;
> But aye grow less and less,
> And die away among the ase.[13]

After scalding oneself, instead of giving way to vigorous profanity, or counting up to one hundred, as Benjamin Franklin suggested, the custom was to blow upon the injured part and repeat:

> There was two angels came from the North,
> One brought fire and the other brought frost;
> Out fire, in frost,
> In the name of Father, Son and Holy Ghost.

There is a fashion even now among the lesser civilized folks to mention the name of a saint or of a divinity, or say something "good" when

[10] J. G. Campbell, "Superstitions of the Highlands and Islands of Scotland," 1900.

[11] Morier, "First Journey through Persia," 1812, p. 230; and "Second Journey through Persia," 1818, p. 239.

[12] Kahn, "Biochemical Studies of Sulfocyanates," 1912.

[13] Ashes.

they see somebody sneezing or yawning. In Scotland, they say to one who sneezes, "Saint Columba be with you." The Jews say, "God give you health." When a child yawns, the nurse must say: "Your weariness and heaviness be on yonder gray stone." The Jews have a custom of giving a new name to a person who is in very bad health. The superstition underlying this is the belief that the Angel of Death is instructed to slay a certain person with a certain particular name. If, however, the name is changed, the angel will be unable to identify the sick man, and death will be thus robbed, for a time at least, of its victim. Among the Celts they give a road name (*Ainm Rothard*) to the person who is ill; it was given upon the luck (*Air sealbhaich*) of the person met.

Contagious diseases had quite a variety of treatment in each case. Joubert,[14] speaking of the transmissibility of illnesses, says:

*D'ou vient qu'une maladie contagieuse se prend plustost d'un vieux a un jeune qu'au contraire. . . . S'il vray que L'argent ne donnent on apportent jamais la peste.*

The ordinary affections of childhood were treated by incantations and exorcisms, or by endeavoring to transfer the disease to the lower animals. For such a disease as smallpox, which counted its victims by the thousands every year, curious medicaments were recommended. Sheep's dung or trickings[15] were administered to such patients. Another procedure was to wrap the patient in a scarlet cloth.

The Chinese make their children wear paper masks on the last night of the year to prevent the god of small-pox from "pouring it out" on them, as he is supposed to attack only pretty children, and thus disfigured they will pass by.[16]

For erysipelas they suggested chantings of witches; but this was not always to be obtained for either love nor money, for the church was quite stringent in its warfare against these old women who rode on broom-sticks and had communion with the devil. In cases where the songs of the "weird women" were not to be heard, several medleys were suggested. The ashes of a woman's hair mixed with the fat of a swine were to be locally applied; or else one half of the ear of a cat was to be cut off and the blood allowed to drop upon the part affected. A less odious procedure and one which has a little sentimentality with it was to rub the ailing part with a golden wedding ring.

The king's evil, or scrofula, was supposed to be curable by the touch of the ruler of England. Dr. Samuel Johnson, in his childhood days, was taken by his father to Queen Anne, in order to cure the child of the malady which affected him. The first king to introduce the king's touch into England was James I. Shakespeare has an allusion to the healing powers of this king in "Macbeth":

[14] Joubert—cited after MacLean's "Collectanea."
[15] Jackson, "Shropshire Folk Lore," 1883.
[16] Doolittle, "Social Life of the Chinese."

> Strangely visited people,
> All swollen and ulcerous, pitiful to the eye,
> The mere despair of surgery, he cures,
> Hanging a golden stamp upon their necks,
> Put on with holy prayers.
> —"Macbeth," Act IV., Scene 3, line 150.

The cure of Naaman, who seems to have suffered from this disease, by the prophet Elisha (Kings, II., 5) was accomplished by advising the great general to bathe in a certain river. A very delightful cure must have been the one mentioned by Soane.[17] A person suffering from scrofula was to kiss seven virgins, daughters of the same mother, for seven days consecutively. Another remedy, less esthetic than the one just mentioned, was to tie a toad's leg around the part affected.

The great evils of cholera, black death or plague, had very many superstitious beliefs as the basis for their cure or avoidance. The condition of affairs caused by one of these dreaded diseases can be appreciated by perusing Daniel Defoe's description of the state of things before and after the fire of London. In Morocco, as a prophylactic procedure, the priests advise the people to avoid sandhills, and to keep close to the walls to avoid the evil spirits.[18] As a charm against cholera, the Japanese hang a bunch of onions or a leaf of kiri, or a rag monkey in front of their house doors.[19] In some parts of Russia, when the approach of cholera is feared, all the village maidens gather together at night, in the usual toilet of the hour, and walk in procession around their village; one girl walking ahead with an Icon, the rest following with a plow.[20]

For consumption, the white plague, which even now demands a heavy toll of human life annually, the people had very many home remedies, which probably did very little remedying. The specifics that were in vogue were rather empiric, to say the least, and sometimes altogether disgusting. To live at a butcher's shop, to suck healthy person's blood, to sleep over a cow-house, to inhale the smoke of a limekiln, to pass through a flock of sheep leaving the fold in the morning, to feed on a large white-shelled snail, to eat muggons or mugwort—all of these were current medicaments in various localities. Children who had tuberculosis were allowed to lie over night at a certain well, named in honor of a certain saint. In order to prevent the spread of this malady in the household, they buried the corpse with the face downward.

> In hectic and consumptive diseases, they pare the nails of the patient, put these parings into a rag cut from his clothes, then wave their hand with the rag thrice around his head, crying "Deas Soil," after which they bury the rag in some unknown place.

[17] Soane, "New Curiosities of Literature," I., 206.
[18] Leared, "Morocco."
[19] MacLean, "Collectanea."
[20] R. Pinkerton, "Russia."

Leprosy was an affliction sent as a punishment of God, according to the beliefs of the ancients. Persons suffering from this illness were driven from the community and were compelled to go about masked, and to cry "Unclean, unclean" upon the approach of a non-leprous individual. Undoubtedly much that was called leprosy in the olden times was in reality syphilis. For a dreadful disease, a dreadful remedy was advised, and surely in those days of slavery the remedy was quite feasible for any one who was able to afford the several coins that a human life cost.

It was anciently believed that a bath made of the blood of infants will cure leprosy, and heal the flesh already petrified.

A sore throat was sometimes treated by a very unpleasant method. The sole of a stocking that had been worn for several days, was taken warm from the foot and tied about the neck of the patient. Sailors who suffer from soreness of the throat, take a raw salt herring with the bone taken out and apply it to the neck, tying a handkerchief over it and keeping it on all night.[21]

Before the discovery of the healing properties of quinine, malaria had perhaps more victims than the other severe sicknesses. At the present time, in the less civilized portions of the globe, they still apply to the magician for a cure for the ague. The chips of gallows and places of execution were thought especially efficacious, and lacking these, the branch of a maiden ash freshly cut from the tree or the water from a church font were used. Certain charms were carried about by those who feared an attack of the fever. A handful of groundsel worn on the bare breast, or else an especially blessed amulet with the inscription of the name of God upon it were suspended from the neck of persons who lived in malaria-infested neighborhoods.

Bring him but a tablet of lead with crosses (and Adonai or Elohim written on it) he thinks it will heal the ague.[22]

Another charm was prepared after the following directions: Peg a lock of hair into an oak tree and then wrench it out. As internal medication, quacks recommend pills made from pitch, or a pill made by rolling up a spider in dough and taking it several times daily; another usage was to take a spider and rub it up alive in butter and then eat the mixture, or else eat while fasting seven sage leaves seven days running. As a barometer, so to speak, of malaria, the people shut up a spider in a box "and as it languishes and dies, so will the ague."[23] Joubert,[24] speaking of the ague, said:

*Est il vray que le fievre quarte s'en va par exces on yoronguerie et qu'elle ne fait jamais sonner campane; et qu'un home en est plus sain toute la rest de sa vie.*

[21] A. H. Markham, "A Whaling Cruise to Baffin's Bay," 1874, p. 253.
[22] T. Lodge, "Wit's Miserie," 1596.
[23] Northal, "Folk Phrases of Four Counties," 1894.
[24] L. Joubert, "Erreurs populaires," 1579.

Not a very profitable transaction to one of the persons concerned is the following Worcestershire superstition:[25]

> Go to a grafter of trees and tell him your complaint. You must not give him any money or there will be no cure. You go home and in your absence the grafter cuts the first branch of a maiden ash, and the cure takes place instantly on cutting the branch from the tree.

A writer of the sixteenth century in England says:

> Tench are good plasters but bad nourishment; for, being laied on the soles of the feet, they often draw away the ague.[26]

An incantation which was to be chanted by the oldest female in the family on Saint Agnes' Eve ran as follows:[27]

> Tremble and go;
> First day shiver and burn.
> Tremble and quake;
> Second day shiver and learn.
> Tremble and die;
> Third day never return.

Epilepsy, the falling sickness, was ever regarded with superstitious dread. For this disease special amulets were worn. The emerald was supposed to possess the power of hindering an attack, or it would break into fragments. Another charm was a ring made of seven six-pences collected from seven maidens from seven parishes. Still others were: Hair plucked from the cross of an ass's shoulder, woven into a chain and worn; nine pieces of silver and nine three half pence collected from as many unmarried persons of the opposite sex—a ring was made from the silver and the cost of making was paid by the copper coins. In France they hung about the child's neck, as Brâssieres relates, *"un tuyau de plume d'oie fermé aux deux extremités et dans lequel est intoduit de mercure liquid."* A broth made in the skull of a dead person; lion's hair chopped up and eaten with milk; three drops of a sow's milk; toadstools fresh and small; the juice of the bracken fern squeezed out when the stem is newly cut across; the fresh blood from a decapitated criminal; a poultice of groundsel applied to the pit of the stomach to set up vomiting—were all used in the various countries of Europe. A procedure, somewhat cruel, was to take a live mole, cut off its nose, and let nine drops of blood fall upon a piece of sugar, which was then to be given to the child. In certain of the village parishes, the epileptic was advised to go into a church at midnight, and to walk three times around the communion table.

The daily cramps and aches and unpleasantnesses that are found in all families had their specific remedies. The usual belly-ache attack passes without the use of any medical agent, and will, in the very great

[25] Noake, "Worcestershire Notes and Queries," 1856.
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majority of cases, pass in spite of any medicament. The layman, however, suffers with aches, takes a reputed remedy, gets well, and firmly believes that it was the special mixture that he had taken which had cured him. For example, they applied in Germany a special concoction recommended by Dr. Christopher Guarnonius of the court of Rudolph II. of Bavaria (1576–1612). It is rather interesting to know how many people were able to obtain this remedy:

Recipe

| | |
|---|---|
| The moss that had grown on the skull of a thief ..... | 2 ounces |
| Man's grease ..... | 2 ounces |
| Grease of Mummy ..... | ½ ounce |
| Man's blood ..... | ½ ounce |
| Linseed oil ..... | 2 ounces |
| Oil of roses ..... | 1 ounce |
| Sole armoniack ..... | 1 ounce |

Mix well and apply locally.

For blows, wound and sores in children, the kissing of the injured part was supposed to be efficacious. The ordinary intestinal colic had quite a number of "specifics" for it. One cure which must have been quite difficult of accomplishment, except by the professional clown, was to stand on one's head for a quarter of an hour.[28] Perhaps after the exertion of standing upon one's head not only the colic but more painful diseases might have been cured. Persons who were liable to the attacks of colicky pains sometimes carried about with them wolf's dung. In his "Diary," Pepy speaks about carrying about oneself a hare's foot. Pepy also gives a prescription, which I shall here repeat:

Balsam of sulphur 3 or 4 drops in a syrup of Coltesfotte, not eating or drinking two hours before or after. The making of this balsam was as follows: "two thirds of fine oyle, and one third of fine Brimstone, sett thirteen or fourteen hours on ye fire, simpering till a thicke stuffe lyes at ye Bottome, and ye Balsom at ye toppe. Take this off, etc.

For cramps they used coffin rings dug out of a grave, bone of hare's foot, the patella of a sheep or lamb, or the tying of a thread around the limb below the thigh. It was also thought that if a rusty old sword were hung near the bed, or if the shoes be placed T- or X-wise over the bed, or if a pan of clean water were kept under the bed, the cramp would leave the patient.

Brimstone and vervain are no honey yet bind them to thine hand and thou shalt have the cramp.[29]

Eating buns or bread baked on Good Friday was supposed to cure diarrhœa.[30]

Besides the cross bun, a small loaf of bread baked on Good Friday morning and carefully preserved as a medicine is good for diarrhœa. It is considered

[28] R. Hunt, "Popular Superstition," 1865.
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that a little of the Good Friday loaf grated into a proper proportion of water is an infallible remedy for this complaint.

Joubert says:

*Des amellittes avec toile d'araigne contre le mal de ventre qu'ont les enfants.*

Another article of diet which the loose-boweled were advised to eat was the first rib of salted roast beef. A more vulgar procedure was to sleep with puppies for several nights until cured of this ailment.

In children, or for that matter in adults, incontinence of water was treated rather quaintly. It was the custom to give to a child who suffered with this defect three roasted mice.

The mouse, being roasted is good to be given to children . . . in their bed; to help them furder, it will dry up the fome and spattle in their mouthes.[31]

Numberless as are the aches that afflict the human being so numerous are the remedies which purport to cure these ailments. For the general aches and pains of muscles, "the laying under your pillow for nine nights a crooked six-pence that has belonged to three young men of the name of John"[32] will cause relief. Sweating was good for the usual muscular aches:[33]

For I do sweat already, and I'll sweat more;
'Tis good they say to cure the aches.

For the household toothache, it was the custom in Shropshire to apply the amputated foot of a live mole (*oont*). For intestinal worms, a live trout was laid on the stomach of the patient, and the water in which earthworms had been boiled was taken internally as a broth.

Boils and abscesses were poulticed for three days and nights, and the bandages were then deposited in the coffin of one awaiting for burial.[34] These patients were also advised "to creep under a bramble that had taken second root at the branch end, moving on the hands and knees." Another procedure which Diaxe speaks about is "walking around six, and crawling three times across the grave of one of the opposite sex on a dark night following the interment"—a rather shivery experience! For a carbuncle:

*On advertit ceux qui ont carboncle de ne passer l'eau, sur pont ou sur bateau, ne en sorte que ce soit.*[35]

A special amulet worn by nursing women to protect them against sore breasts was a heart-shaped medal made of the lead cut off the quarrels of a church window at midnight. Bleeding of the nose was prevented, so was it thought, by wearing a red ribbon around the neck, or by suspending from the neck a dead dried toad, or a large key. A lace

[31] Bullein, "Bulwarke of Defence," 1562, p. 84.
[32] Mrs. Hannah More, "Tawny Rachel."
[33] Webster, "Cure for a Cuckold."
[34] T. Diaxe, "Bibliotheca Scholastica Instuctissima," 1633.
[35] L. Joubert, *loc. cit.*

given unasked and received without thanks from one of the opposite sex will sometimes stop epistaxis.

**We see that a bone taken out from a carp's head stauncheth blood, and so will none other part of the fish.[36]**

Poisoning had and still has its superstitious treatment. The unicorn's horn was remedy for all poisons. The horn of a unicorn (the animal is not to be found classified in the modern books on zoology) was worth the price of half a city.[37] It is needless to say that this remedy was not within the reach of everybody, and less poetic remedies were used by the ordinary people. The quacks, however, made huge profits selling powdered unicorn's horn to the gullible public. It is more than a suspicion that the stuff sold was made from the horns of an ox or a ram. "Plain proof declares one poison to drive out another."[38] and they certainly gave dangerous medications to persons that were poisoned. If the patient did not succumb to the original draught, he had very good chances of dying as a result of the remedy.

For the bites of animals, many queer remedies were in vogue. A patient bitten by a dog used to eat the hair of this dog. A person stung by an adder was advised to kill the animal and apply some of its fat to the wound, or else to fry the adder and strike the place bitten with the hot flesh, or else to make an ointment from its liver and apply it locally (Noake).

**'Tis true a scorpion's oil is said**
**To cure the wounds the vermin made.**

The *Boston Journal of Chemistry* (1879) tells of a druggist from Texas who paid two hundred and fifty dollars for a "mad-stone" which had the powers to cure the bites of animals. A custom, which is practised by the Hottentots also, is to kill a chicken and to thrust the bitten part into the stomach of the bird, and there let it remain till the chicken becomes cold. If the flesh of the fowl becomes dark, a cure was supposed to have been affected; if not the poison had been absorbed by the person bitten.

To relieve deafness, they applied eels to the ears. For the cure of dropsy "all-flower water" was recommended. Another method for the treatment of dropsy is the one reported by Joubert:

***Pisser durant neuf matins sur le marrube avant que le soleil L'ait touche et a mesure que la plante mourra, le ventre se desenflera.***

For the cure of rickets, they suggested sleeping on a bed of green bracken, or passing the child nine times through a holed stone against the sun. In Oxfordshire, they relieved heartache by giving the patient the last nine drops of tea from the tea-pot after the guests had been served.

[36] Scott, "Discoverie of Witchcraft," XIII., p. 10.
[37] Dekker, "Gull's Hornbook," II.
[38] Grange, "Golden Aphroditis," III.

Rheumatism and the joint pains were treated both by charms and by concoctions. To carry the forefoot of a hare, or a raw potato, or a horse chestnut in one's pocket ameliorated an attack of the severe pain that accompanies all joint affections. Sailors when attacked by rheumatism wear a flannel shirt nine times dyed. The landlubber has to be satisfied with sleeping on a hop pillow, or leaning for one night against the bellows.

Common nostoc, commonly called star-jelly, a trembling gelatinous fungus that springs up suddenly after rain, is by superstitious persons believed to possess virtue as a vulnerary and in pains of joints.[39]

Walking in fields on Friday before sunrise was advised to patients suffering with gout. Pliny says:

*Podagras mitigati pede leporis viventis absciso si quis secum assidue habeat.*

Dropping of excreted water upon the feet, or applying the lodestone were thought of benefit in this disease.

*D'où vient que les chapons sont plus et plustot gouteux que le coqs si la castration est remedy à la goutte.*

For billiousness and jaundice, quite a number of the most disgusting mixtures were used. Lice seem to have been quite a current specific for this affection; lice served in all manners and form, and in all ways of preparation. Nine lice to be eaten on a slice of bread and butter;[40] or else nine lice swallowed alive,[41] were two of the most conventional ways of taking this medicine. Poor, dirty communities need never complain of jaundice, for they always have the wherewithal to cure it.

Die of jaundice, yet have the cure about you!—lice, large lice, begot of your own dust and the heat of brick kilns.[42]

Goose dung made into pills and eaten several times a day was another very tasteful medicament, which was especially in style in Staffordshire. In Franche Comte, hawkweed and carrots are still considered specifics for jaundice. A more convincing recipe is the one recommended by Graham:[43]

Raw eggs eaten two at rising, fasting, and one every four hours during the day at times when the stomach is empty. *Probatum est.*

Fall to your cheese-cakes, curds, and clouted cream,
Your fool, your flaunes, and swill of ale a stream
To wash it from your livers.[44]

Cancer, it was vaguely believed in certain portions of the world, was due to the growth of a toad-like body in the human organism. The first thing that was, therefore, applied to a cancerous surface was a dried toad. The doctors recommended the following composition: To a yolk

[39] Lindley, "Vegetable Kingdom," 1846.
[40] Narsnet, "A Declaration of Popish Impostures," 1603.
[41] Isaac Walton, "Complete Angler."
[42] Beaumont and Fletcher, "Thierry and Theodoret," V., 1.
[43] Graham, "Domestic Medicine."
[44] Ben Jonson, "Sad Shepherd," I., 7.

of an egg add salt, then make a salve and apply. A prescription which was given to Pope Clement VII. to relieve his carcinoma (I believe) read as follows:

Take of

| | |
|---|---|
| Cinnamon | 10 ounces |
| Ginger | 5 ounces |
| Zedoary | 4 ounces |
| Nutmeg | 3 ounces |
| Elder root | 2 ounces |
| Calamus | 1 ounce |

Dissolve in a decoction of lemon juice mixed with wine.

Take a half pint before meals in the time when the moon is in Cancer, Leo or Virgo.

Brâssieres, speaking about the errors of medicine, relates the following procedure for the treatment of cancer:

*Chacun connait ce vieux prejuge que l'on ne rencontre plus que chez de pauvres femmes du siècle dernier. Atteintes de cancer, elle nourissent avec soin, pour ne pas en etre devoreés ce pretendu animal, en appliquant tous les matins sur leur plaies une tranche fraiche de veau.*[45]

For the treatment of urinary lithiasis, very many curious means were in use in the middle ages. Goat's urine was recommended by all the Arabian physicians to be taken internally. The Talmud mentions quite a remarkable cure for the kidney or bladder stone. Baas speaks of this method in a very bitter way, but it is no more vulgar than many similar customs in different countries. Baas's "History of Medicine" is rather unfair and partial in its treatment of Hebrew contributions to medical knowledge. The method to which I am referring was cited in another paper by me on the history of the lithotomy operation.[46]

A bone from the head of a carp is said to be good for apoplexy or the falling sickness.[47]

All flower water was given to patients suffering with asthma. This "all-flower water" was called *urina vaccæ*. Patients complaining of chorea were usually taken to one of the holy shrines where remarkable cures were said to be performed. Lourdes in France still boasts of the survival of this ancient custom. Emile Zola in his masterly novel, bearing the name of this city, vividly describes how the sick and suffering from all parts of France come to this town and expect complete restoration to normal health.

The next is Vitus sodde in Oyle, before whose ymage faire,
Both men and women bringing hennes for offering do repair;
The cause whereof I do not know, I think for some disease
Which he is thought to drive away from such as him do please.[48]

For shingles, herpes zoster, there was practised the following cure:

[45] A. F. E. Brâssieres, "Sur les Erreurs en Medicine," 1860.

[46] Kahn, "History of the Lithotomy Operation," *Medical Record*, 1912.

[47] J. Schroedems, "Zoology," 1659.

[48] Googe, "Popish Kingdom," 1570, p. 54.

The patient was taken to running water, where seven rushes were picked and were laid across the affected part; the rushes were then thrown into the stream. This was repeated on three consecutive days. *"Cataplasme de chair de vautour avec les vifs"* was applied locally to hare-skin disease.[49] *Si poter foureure et plumes de Vautour sur L'estomac luy peut servir en quelque chose?*[50]

Procreative disease was, of course, more inviting to quack remedies than any other ailment of any other part of the body. The richest quacks and those that do the most flourishing business, are those charlatans who pretend to cure the sexual illnesses. I shall not discuss the remedies for all genital disorders. Sterility, however, presents very interesting points, and I shall just briefly give some of the ancient customs that were common for the treatment of this "deficiency." In all countries, nulliparous women traveled to holy places and prayed in the churches of the holy saints to grant them issue. At Jarrow, in England, brides sit themselves in the chair of the Venerable Bede. The old English dramatist, Heywood,[51] relates of the traveling to holy shrines of sterile women in order to become fruitful.

> Another miracle eke I shall you say
> Of a woman which that many a day
> Had been wedded, and in all that season
> She had no child, neither daughter nor son,
> Wherefore to St. Modwyn she went on a pilgrimage,
> And offered there a live pig, as is the usage
> Of the wives that in London dwell.

In Egypt and other semi-civilized countries, the women who desire to become pregnant, pass several times silently under the corpses that hang on the gallows, or else they bathe in the dirtiest puddles where carrions and carcasses of dead animals abound.

Juvenal[52] says in one of his satires:

> *Steriles moriuntur, et illis*
> *Turgida non prodest condita pyxide Lyde.*

Another Latin writer states:

*Credebant antiqui mulierem sterilem concipere posse, si pyxide araneam inclusam gestit in sinu.*

Sage and salts were the ordinary ingredients of the prescriptions which were given to women in order to cause them to become *enceinte*. On the other hand,

> Gold dust is taken internally when to prevent offspring is desirable. Shot is swallowed with the same intention, and also scrapings from a rhinoceros horn.[53]

A little superstition seems to be a universal trait, but it is the excess of it which has caused so much harm and misery.

[49] R. Cotgrave, "Dictionaire," 1611.
[50] P. Bailly, "Questiones Naturelles et Curieuses," 1628.
[51] John Heywood, "A mery play of Johan, Tyb, and Sir Johan," 1533, p. 27.
[52] Juvenal, "Satires," II., 140.
[53] Leared, "Morocco and the Moors," p. 281.

# LESTER F. WARD AS SOCIOLOGIST

By Professor E. A. ROSS

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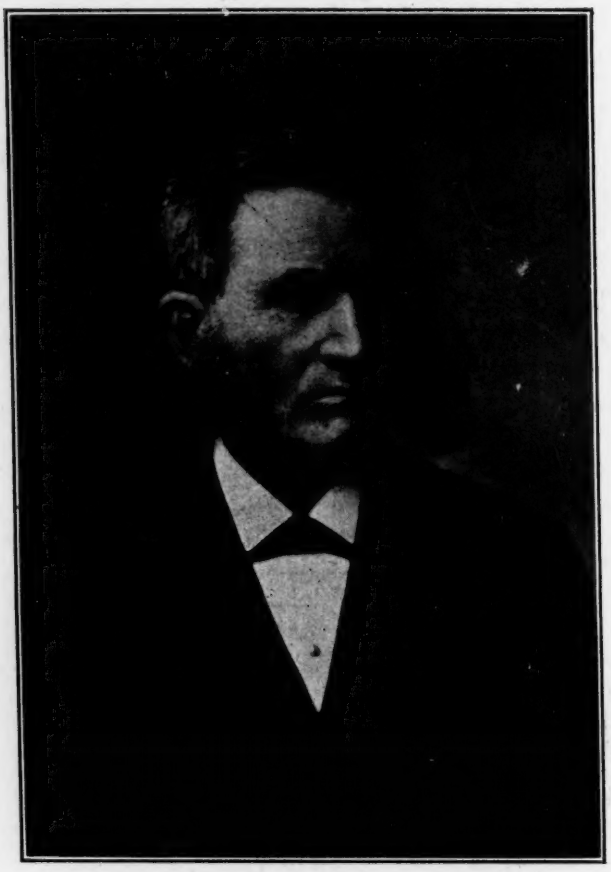
THE late Lester F. Ward was a many-sided man and his fifty productive years brought forth a great number of contributions to botany, paleobotany, geology, psychology and anthropology. For a long time as paleobotanist of the U. S. Geological Survey he led as it were a double intellectual life, devoting his office hours to fossil plants and his spare time to the sciences relating to man. He had two reading publics, two groups of scientific acquaintances, two sets of correspondence. When traveling about in Europe one day he might hear his own contributions discussed in a university seminar on sociology, while the next day he would be the guest of an Italian count who knew nothing of his sociological writing but loved him as a brother naturalist. Toward the latter part of his life, however, sociology engrossed his energies and it is as sociologist that he will be known to the future.

Thirty years ago when Dr. Ward made his début with his monumental "Dynamic Sociology," the influence of Spencer was completely dominant save among the handful of socialists. Social evolutionism insisted that the improvement of society must of necessity be slow. No factors could be relied on for the promotion of progress save the blind forces which had brought mankind out of prehistoric savagery. The state, being in origin and spirit coercive, could do nothing to accelerate progress, although by ill-advised intermeddling it could do much to hinder it. Beyond protecting life and property the state should keep its hands off.

Ward was the first who, digging as deep as Spencer and basing himself with equal confidence upon modern science, built up a totally different social philosophy. He rejected the dogma of the superiority of the "natural" and insisted that human progress is a matter of art, is "artificial." There is always an artificial which, from man's point of view, is better than the natural. Instead of "Back to nature!" the cry ought to be "Forward to art!" The social progress we have had has come about by the haphazard contributions of a small number of originative individuals; but the rate of movement can be enormously accelerated provided society intelligently sets about it.

The state has been coercive, but it is fit for higher purposes. We are still in the stone age of politics. It is practicable gradually to mould government into an instrument of collective intelligence. War, oppres-



LESTER F. WARD.

sion, exploitation and superstition—the chief obstacles to progress—are rooted in general ignorance and may be removed by the diffusion of knowledge. Universal education is, therefore, the one means government may employ to hasten the advancement of mankind.

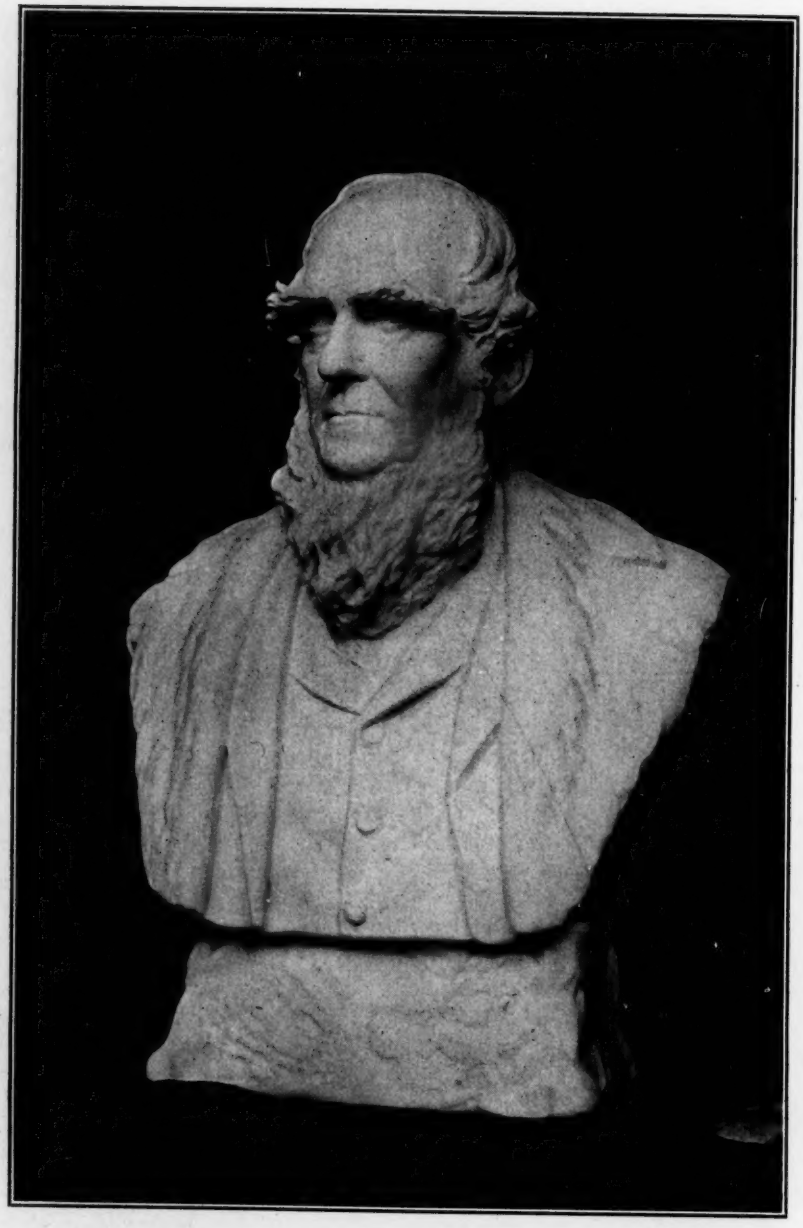
His "Psychic Factors of Civilization" published in 1893 laid a deeper foundation for his program of willed social progress by setting forth the rôle of mind in organic evolution. His daring comparison of "the economy of Nature and the economy of Mind" would, at any time between the sixth century and the seventeenth, have been generally regarded as impious and inspired by the devil. Twenty years ago biological adaptation was still regarded as something to pattern after. Ward showed, however, that improvement by natural selection is frightfully wasteful. Nature's way of getting results is costly and should not be imitated by man. As soon as mind comes into the world a better method of adaptation is discovered. It is, therefore, in order for intelligence to search for shortcuts to happiness. Beyond democracy Ward sees a form

of government he calls "sociocracy" in which the control of the social future rather than the adjustment of private property interests will be the chief function.

Ten years later Ward gave out "Pure Sociology," in which he traced the origin of society, the course of social development and the means by which civilization had been built up. This was followed soon by "Applied Sociology," crown of his system and his last word on the problem of accelerating social progress. While insisting equally with the socialists on the lop-sidedness of modern progress and the non-participation of the masses in the fruits of the machine era, he utterly refused to pin his hope for the future to single tax, collectivism or any economic reform whatsoever. In his view no purely economic reform can put an end to exploitation, because it leaves untouched the great inequality of intelligence which alone makes exploitation possible. Education, therefore, is the antidote not only to contemporary exploitation, but to such exploitations as may be called into being by unforeseen future developments.

Ward believed that native talent or genius appears about as frequently in one social class as another, in working-class children as in the children of the well-to-do. The fact that through the centuries most of the great men have sprung from the comfortable classes simply proves the might of opportunity. The bringing of full educational opportunities within reach of all children will enable society for the first time to realize on all its latent assets of human capacity.

Ward lived to see his ideas generally accepted by thoughtful men. No longer is progress identified with the method of natural selection. To-day no one advocates surrender to the blind forces of social development. The *laissez faire* theory has been abandoned. The functions of government have greatly multiplied, especially on the side of research, education and stimulation. With this about-face Lester F. Ward had something to do. He never reached the people, but he reached the people who reached the people. His program remains yet to be realized, but the leaders are moving in the direction he pointed.



Sir Joseph Dalton Hooker.

# THE PROGRESS OF SCIENCE

## *LORD AVEBURY AND THE PASSING OF THE VICTORIAN ERA*

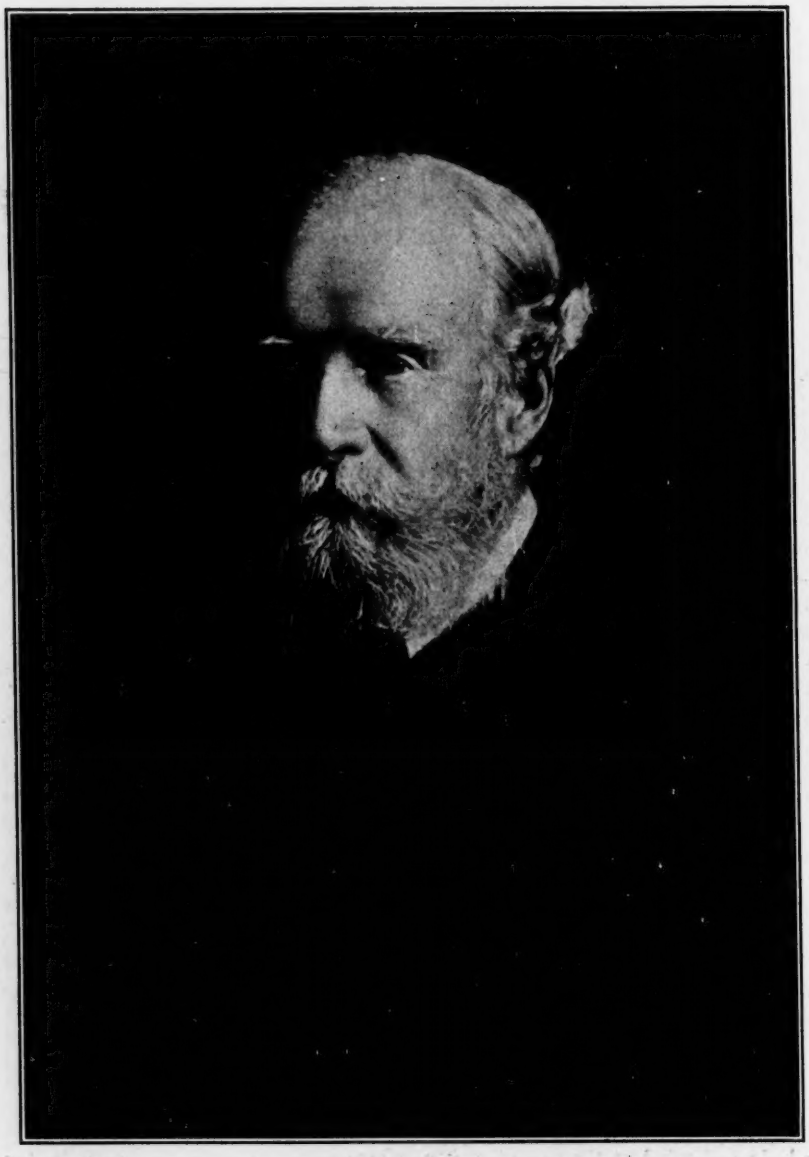
DURING the nineteenth century, England was clearly the leading nation of the world. Previously it had been rivaled by Italy and France, even by Austria and Spain; now it has to contend for supremacy with Germany and the United States; soon Russia and China will be added; perhaps the Balkan states and Japan. The races which successively invaded the British islands were of fine stock; their struggles and their union left a people of high quality. In the development of the applications of science England took the lead, owing to the genius of its people, the convenient supply of iron and coal and the maritime situation. Vast wealth was accumulated, the most able and vigorous of its people being the most successful. Innumerable families were established with inherited ability and wealth. From them came the great men who gave distinction to the Victorian era.

Four years ago, after comments on Darwin and Tennyson in view of the centenary of their births, it was here remarked: "The greatness of the Victorian era is now represented among the living by men of science—Hooker, Wallace, Avebury, Huggins, Galton." Only Wallace is now left, still vigorous in body and mind at the age of ninety years. One after the other the world lost Lister, Huggins and Galton; Sir Joseph Dalton Hooker died on December the tenth last, in his ninety-fifth year; Lord Avebury died on May 28 at the age of seventy-nine years.

Avebury—not every reader of the works of Sir John Lubbock will recognize him under the name he bore in the peerage—was not among the greatest men of the nineteenth century, but there is no finer example of the performance of the Victorian era. Like Hooker he inherited from his father superior natural ability directed to scientific work and at the same time ample wealth. He was perhaps without peer as an amateur, nor is he likely to have a successor. He is known for a long series of scientific and literary books which attained circulations in English and foreign editions running into the hundreds of thousands. As a neighbor and friend of Darwin's at Down he may have been influenced by him in his work on natural history, beginning with "The Prehistoric Times" and "Ants, Bees and Wasps." Equally popular with his works on anthropology, entomology and botany were his "Scenery of England" and "Scenery of Switzerland," and his books of literary philosophy, such as "The Pleasures of Life" and "The Beauties of Nature."

While writing so many books concerned with science and letters and while most active in scientific and educational organization—he was president of the British Association at its jubilee meeting and president of a long list of scientific societies—Avebury conducted the banking business which he inherited from his father. He published important brochures on currency and commerce and had large influence in the financial world. At the same time he was an active member of parliament, taking special interest in questions of education and social reform, as in initiating the movement for early closing and public holidays.

Avebury so completely represented many aspects of the Victorian era that his death typifies the passing of that great period in history. Rule by the best and work for love of the work are



LORD AVEBURY.

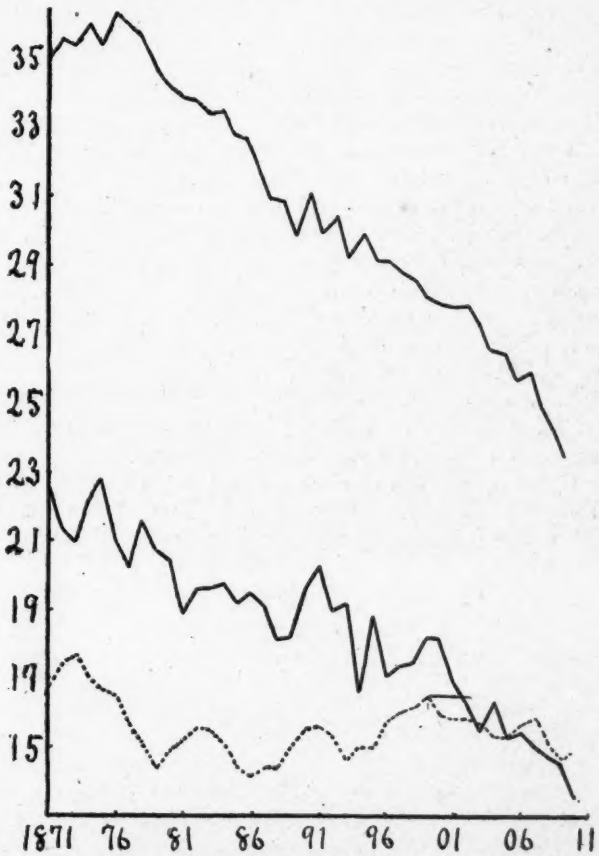
fine ideals in politics and in science, yet it is now scarcely a compliment to call a man an aristocrat and an amateur. Avebury himself could not follow the newer order. With other representatives of the old whig and liberal families, he parted from Gladstone in 1886 over the question of home rule for Ireland. He was out of sympathy with the radical and socialistic democracy into which the party to which he once belonged has moved. Amateurism in science, like aristocracy in government, is no longer credited. Avebury's books are not now read so eagerly as in the past, and it may be that such books will not hereafter be written. We have moved forward into a new age

which we may hope is an advance in the civilization of the world. But the Victorian era and its great men are not less memorable because they belong to a past which can not return.

### *VITAL STATISTICS AND THE MARRIAGE RATE*

TABLES of vital statistics make an appeal to the imagination not surpassed by any writings in verse or prose. The events in the career of an individual are insignificant compared with the vast exhibit of human life displayed in tables of births, marriages and deaths. If the birth of a child is of more consequence than anything else, it is surely momentous that in a single country such as England half a million children were not born last year who would have been born if the birth rate had remained what it was a few years ago. If one tries to fancy the tragedy of each single death, it is quite beyond the range of the imagination to realize the meaning of a statement such as thirty years ago there died in England more people from scarlet fever than from cancer, whereas in 1910 there were 2,370 deaths from scarlet fever and 34,607 deaths from cancer.

Reference has been made here to birth rates and death rates as compiled in the excellent report of the registrar general of England, and it may be worth while to call attention to the data concerning marriage rates. The decreasing birth rate, the employment of women in industry and other social conditions lead many to surmise




BIRTH RATES, DEATH RATES AND MARRIAGE RATES IN ENGLAND AND WALES FOR THE PAST FORTY YEARS. The birth rate has decreased from 36.3 to 24.4, the death rate from 22.6 to 13.5; the marriage rate has remained about stationary since 1880.

that marriage is less common now than formerly, but that is not the case. There has been little or no change in the marriage rate or in the proportion of people married in the course of the past fifty years. Curves are here drawn from the report of the English registrar general for births, marriages and deaths.

These curves exhibit the remarkable decline in the birth rate and in the death rate. If they should continue in their present course there would be neither births nor deaths in England seventy-five years hence. As a matter of fact, the death rate can not decrease much farther. The very low figure of 13.5 deaths for each thousand of the population is due not only to improved conditions and a great decrease in the deaths of children and of those under forty which can be maintained and increased, but also to the fact that a birth rate declining in the course of a single generation from 36 to 24 has given a population containing a comparatively small percentage of old people and of young children among whom deaths are most common. What will happen to the birth rate, no one can foretell. In France the births have fallen below the deaths, and this may happen in England and in Germany.

Unlike the birth rate and the death rate, the marriage rate has not altered appreciably in the course of the past forty years. It was, it is true, somewhat higher in the early seventies, but it was only 16 in the early sixties. The variation from year to year is caused by economic and social conditions, so that the marriage rate has been called the barometer of the prosperity of a nation. The lowest marriage rate in England was 14.2 in 1886; it increased to 16.5 in 1899 and has since declined to 15. The constitution of the English population is favorable to a low death rate, but to a high birth rate and a high marriage rate. Among each million of the population there were in 1901 in England 257,525 between the ages of 20 and 34; in Germany, 239,857; in France, 233,548; in Sweden, 210,773. Most marriages occur between these ages and nearly all children are born when the mother is between these ages. The excess of people of these ages in Great Britain would account for an excess of marriages and births of 10 per cent. over France and 20 per cent. over Sweden. As the English population becomes stationary we may expect a decrease in marriages and births to that extent.

In Germany as in England the marriage rate is now about the same as it was thirty years ago. It has increased somewhat in France. The percentages of women between 15 and 49 years old who were married in 1901 was: In France, 57.7; in Italy, 56.1; in the German empire, 52.8, and in England, 49.2. In the course of twenty years there was an increase in France and Italy, a stationary condition in Germany and a decrease in England. In France, where the children are the fewest, the proportion of married women is the greatest as is also the number of unlegitimized unions. The decreasing birth rate is not caused by a decreasing marriage rate. It appears that it is due to the fact that people now marry with the intention of having no children or no more children than is convenient.

## *SCIENTIFIC ITEMS*

WE record with regret the death of Dr. William Hallock, professor of physics in Columbia University, and of Dr. William McMurtrie, one of the leading industrial chemists of New York City.

THE Paris Academy of Sciences has elected Professor W. M. Davis, of Harvard University, a correspondent in the Section of Geography and Navigation, in the place of the late Sir George Darwin.—The mathematical works of the late Henri Poincaré are to be published by the firm of Gauthier-Villars, under the auspices of the minister of public instruction and the Paris Academy of Sciences.